

DoD Standard Design for Vertical ASTs



Ms. Terri Regin, PE
27 April 2015



OVERVIEW

- Unified Facilities Criteria and ASTs
- New Features
- Tank Sizing & Layout
- Drawing Excerpts
- Tank Bottom & Roof
- Dike Area
- Questions





DoD Fuels Facilities Documents

- **Unified Facility Criteria (UFCs)**

- Authoritative, mandatory unless waived by Service HQ

- **Standard Designs (Std Dsn)**

- Starting point for design, edited for site adapt
 - Engineering Design is still needed
 - Identifies preferences and design choices
 - Includes designer notes
 - Lists which UFGS to be used
 - Major Deviations require Service HQ approval

- **Unified Facilities Guide Specifications (UFGS)**

- Edited for the job
 - Designer choices in brackets

Unified Facilities Criteria (UFC)

- **UFC 3-460-01 Design: Petroleum Fuels Facilities**
 - Guidance for all new design and construction

- **Chapter 2 – General Design Information**
 - Fire protection, Safety
 - Environmental
 - Electrical Design & Area Classifications
 - Security
 - Emergency shutdown



Unified Facilities Criteria (UFC)

■ Chapter 8 – Atmospheric Tanks

- Tank Spacing
- ASTs, vertical, horizontal,
- USTs
-
- Diking, spill containment
- Vapor Emission Control systems
- Tank Roofs, floating pans
-
- Foundations, tank bottoms
- Appurtenances
- General Design Considerations
-
- Follows/directs use of NFPA 30, 30A
- Directs use of DoD Standard Design AW 78-24-27



DOD STANDARD DESIGN AW 78-24-27

FEBRUARY 2015

INDEX OF DRAWINGS

INDEX OF DRAWINGS			145-03	
SHEET NO.	DRAWING NUMBER	DESCRIPTION	SHEET NO.	DRAWING NUMBER DESCRIPTION
1	0-01	TITLE SHEET	26	30-01 30-000 FRT. TANK
2	0-02	LEGEND AND ABBREVIATIONS	27	30-02 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
3	0-03	GENERAL DETAILS	28	30-03 30-000 FRT. TANK
4	0-04	GENERAL DETAILS	29	30-04 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
5	0-05	GENERAL DETAILS	30	30-05 30-000 FRT. TANK
6	0-06	GENERAL DETAILS	31	30-06 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
7	0-07	GENERAL DETAILS	32	30-07 30-000 FRT. TANK
8	0-08	GENERAL DETAILS	33	30-08 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
9	0-09	GENERAL DETAILS	34	30-09 30-000 FRT. TANK
10	0-10	GENERAL DETAILS	35	30-10 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
11	0-11	GENERAL DETAILS	36	30-11 30-000 FRT. TANK
12	0-12	GENERAL DETAILS	37	30-12 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
13	0-13	GENERAL DETAILS	38	30-13 30-000 FRT. TANK
14	0-14	GENERAL DETAILS	39	30-14 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
15	0-15	GENERAL DETAILS	40	30-15 30-000 FRT. TANK
16	0-16	GENERAL DETAILS	41	30-16 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
17	0-17	GENERAL DETAILS	42	30-17 30-000 FRT. TANK
18	0-18	GENERAL DETAILS	43	30-18 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
19	0-19	GENERAL DETAILS	44	30-19 30-000 FRT. TANK
20	0-20	GENERAL DETAILS	45	30-20 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
21	0-21	GENERAL DETAILS	46	30-21 30-000 FRT. TANK
22	0-22	GENERAL DETAILS	47	30-22 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
23	0-23	GENERAL DETAILS	48	30-23 30-000 FRT. TANK
24	0-24	GENERAL DETAILS	49	30-24 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
25	0-25	GENERAL DETAILS	50	30-25 30-000 FRT. TANK
26	0-26	GENERAL DETAILS	51	30-26 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
27	0-27	GENERAL DETAILS	52	30-27 30-000 FRT. TANK
28	0-28	GENERAL DETAILS	53	30-28 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
29	0-29	GENERAL DETAILS	54	30-29 30-000 FRT. TANK
30	0-30	GENERAL DETAILS	55	30-30 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
31	0-31	GENERAL DETAILS	56	30-31 30-000 FRT. TANK
32	0-32	GENERAL DETAILS	57	30-32 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
33	0-33	GENERAL DETAILS	58	30-33 30-000 FRT. TANK
34	0-34	GENERAL DETAILS	59	30-34 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
35	0-35	GENERAL DETAILS	60	30-35 30-000 FRT. TANK
36	0-36	GENERAL DETAILS	61	30-36 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
37	0-37	GENERAL DETAILS	62	30-37 30-000 FRT. TANK
38	0-38	GENERAL DETAILS	63	30-38 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
39	0-39	GENERAL DETAILS	64	30-39 30-000 FRT. TANK
40	0-40	GENERAL DETAILS	65	30-40 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
41	0-41	GENERAL DETAILS	66	30-41 30-000 FRT. TANK
42	0-42	GENERAL DETAILS	67	30-42 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
43	0-43	GENERAL DETAILS	68	30-43 30-000 FRT. TANK
44	0-44	GENERAL DETAILS	69	30-44 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
45	0-45	GENERAL DETAILS	70	30-45 30-000 FRT. TANK
46	0-46	GENERAL DETAILS	71	30-46 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
47	0-47	GENERAL DETAILS	72	30-47 30-000 FRT. TANK
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53	0-53	GENERAL DETAILS	78	30-53 30-000 FRT. TANK
54	0-54	GENERAL DETAILS	79	30-54 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
55	0-55	GENERAL DETAILS	80	30-55 30-000 FRT. TANK
56	0-56	GENERAL DETAILS	81	30-56 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
57	0-57	GENERAL DETAILS	82	30-57 30-000 FRT. TANK
58	0-58	GENERAL DETAILS	83	30-58 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
59	0-59	GENERAL DETAILS	84	30-59 30-000 FRT. TANK
60	0-60	GENERAL DETAILS	85	30-60 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
61	0-61	GENERAL DETAILS	86	30-61 30-000 FRT. TANK
62	0-62	GENERAL DETAILS	87	30-62 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
63	0-63	GENERAL DETAILS	88	30-63 30-000 FRT. TANK
64	0-64	GENERAL DETAILS	89	30-64 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
65	0-65	GENERAL DETAILS	90	30-65 30-000 FRT. TANK
66	0-66	GENERAL DETAILS	91	30-66 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
67	0-67	GENERAL DETAILS	92	30-67 30-000 FRT. TANK
68	0-68	GENERAL DETAILS	93	30-68 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
69	0-69	GENERAL DETAILS	94	30-69 30-000 FRT. TANK
70	0-70	GENERAL DETAILS	95	30-70 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
71	0-71	GENERAL DETAILS	96	30-71 30-000 FRT. TANK
72	0-72	GENERAL DETAILS	97	30-72 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
73	0-73	GENERAL DETAILS	98	30-73 30-000 FRT. TANK
74	0-74	GENERAL DETAILS	99	30-74 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
75	0-75	GENERAL DETAILS	100	30-75 30-000 FRT. TANK
76	0-76	GENERAL DETAILS	101	30-76 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
77	0-77	GENERAL DETAILS	102	30-77 30-000 FRT. TANK
78	0-78	GENERAL DETAILS	103	30-78 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
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81	0-81	GENERAL DETAILS	106	30-81 30-000 FRT. TANK
82	0-82	GENERAL DETAILS	107	30-82 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
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85	0-85	GENERAL DETAILS	110	30-85 30-000 FRT. TANK
86	0-86	GENERAL DETAILS	111	30-86 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
87	0-87	GENERAL DETAILS	112	30-87 30-000 FRT. TANK
88	0-88	GENERAL DETAILS	113	30-88 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
89	0-89	GENERAL DETAILS	114	30-89 30-000 FRT. TANK
90	0-90	GENERAL DETAILS	115	30-90 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
91	0-91	GENERAL DETAILS	116	30-91 30-000 FRT. TANK
92	0-92	GENERAL DETAILS	117	30-92 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
93	0-93	GENERAL DETAILS	118	30-93 30-000 FRT. TANK
94	0-94	GENERAL DETAILS	119	30-94 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
95	0-95	GENERAL DETAILS	120	30-95 30-000 FRT. TANK
96	0-96	GENERAL DETAILS	121	30-96 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
97	0-97	GENERAL DETAILS	122	30-97 30-000 FRT. TANK
98	0-98	GENERAL DETAILS	123	30-98 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION
99	0-99	GENERAL DETAILS	124	30-99 30-000 FRT. TANK
100	0-100	GENERAL DETAILS	125	30-100 30-000 FRT. TANK NOZZLE SCHEDULE & INTERPRETATION

Specifications

UFGS	Title	Published
33 56 13.13	Steel Tanks With Fixed Roofs	May-2012
33 56 13.15	Undertank Interstitial Space	May-2012
33 56 63	Fuel Impermeable Liner System	Apr-2006
32 13 15.20	Concrete Pavement for Containment Dikes	Nov-2010
09 97 13.15	Low VOC Polysulfide Interior Coating of Welded Steel Petroleum Fuel Tanks	Feb-2015
09 97 13.27	Exterior Coating of Steel Structures	Feb-2010

AST Standard Design

- **Vertical Steel Tanks in JP-5 or JP-8/F-24 Service**
 - Can be used for other products
- **For >5K, <100K BBL Vertical ASTs**
- **Fixed roof, floating pan**
 - Considerations given for tanks w/o pans
- **For new construction, but can be used for renovations**
- **Elevated and non-elevated foundations**
 - Areas with/without high water tables
- **Requires design in accordance with API 650**
- **For CONUS and OCONUS**

History & Current Status

- **Original Design in mid 80's**
- **Update in Feb 1993**
 - Shop drawing detailed
 - Only included Tank, not site layout
- **Last Update Published in 2012**
 - Rely more on API 650, prescribe government preferences
- **Current Update 2015**
 - Includes piping/dike details
- **Will post to USACOE Std Dsn website**



AST Standard Design

- **Has sidestream filtration option**
 - Fuel polishing, water drawoff
- **Incorporates DLA ATG policy for gauge wells**
 - Fuel level and water detection
- **Includes 2 sheets designer notes**
 - Use in corrosive and northern environments
 - Tank sizing and site planning
 - Foundation options
 - Tanks without floating pans



AST Standard Design

- Useable Volumes
- High/Low Level Control & Shutoff Logic
- Roof Structure, Compression Ring
 - Single column for diameters $126 \text{ ft} > D > 91 \text{ ft}$
 - No columns for diameters $< 91 \text{ ft}$
- UFC 3-460-01 Was Updated To Resolve Conflicts.

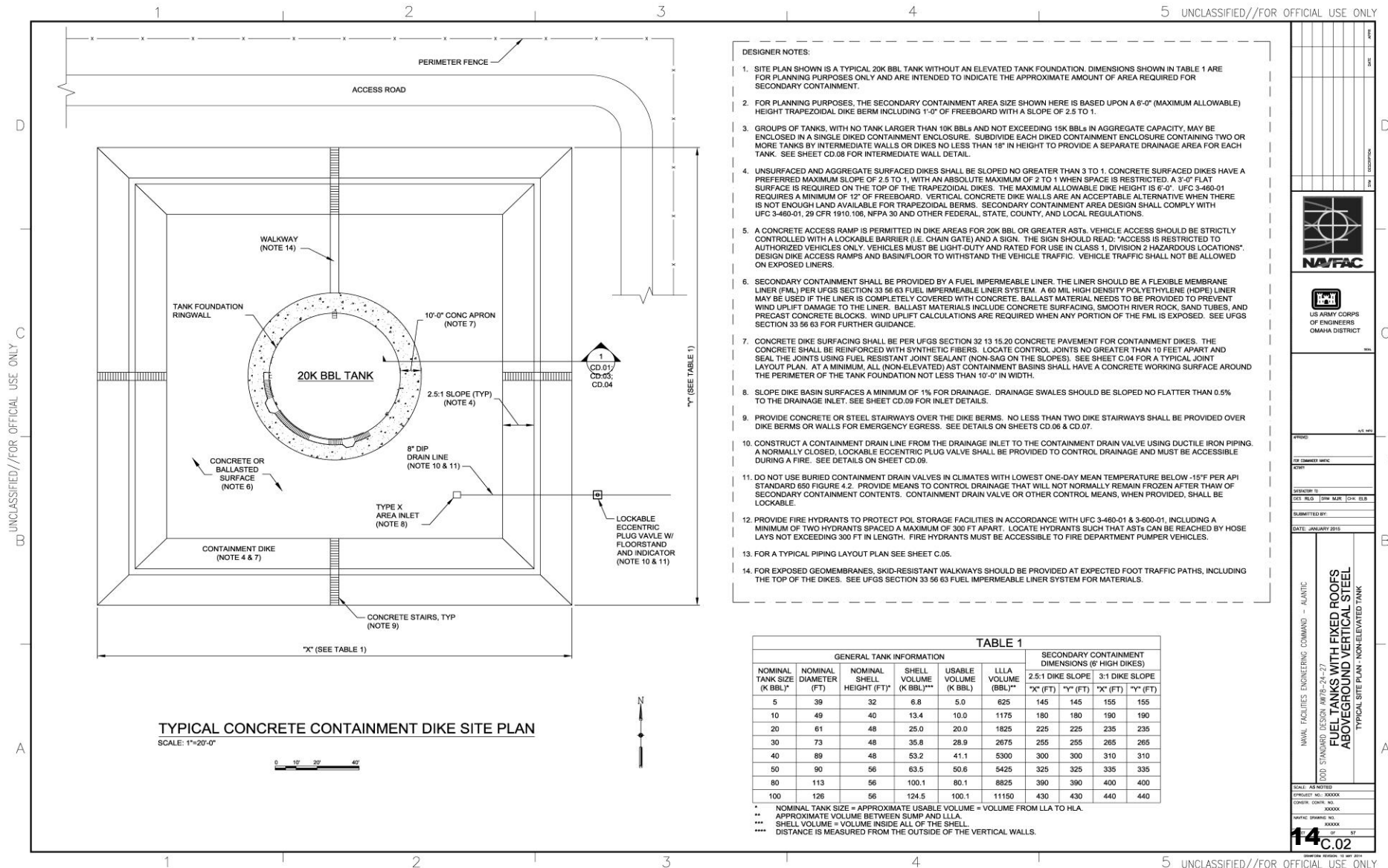




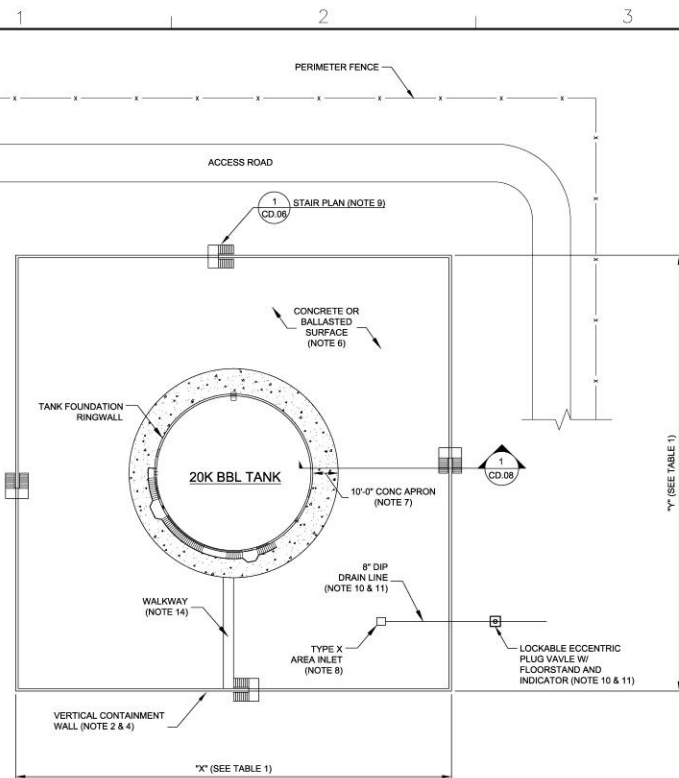
AST Standards Additions

- **Typical Site Plans**
- **Piping Layout Plan**
- **Containment System Details**
- **Stairway Details**
- **Misc Piping Details**
- **Pipe Support Details**
- **Typical Electrical Details**

Typical Site Plan – Non-Mounded Tank



Typical Site Plan – Vertical Containment Walls



TYPICAL VERTICAL CONTAINMENT WALL SITE PLAN
SCALE: 1"=20'-0"

0 10' 20' 40'



DESIGNER NOTES:

1. SITE PLAN SHOWN IS A TYPICAL 20K BBL TANK WITHOUT AN ELEVATED TANK FOUNDATION. DIMENSIONS SHOWN IN TABLE 1 ARE FOR PLANNING PURPOSES ONLY AND ARE INTENDED TO INDICATE THE APPROXIMATE AMOUNT OF AREA REQUIRED FOR SECONDARY CONTAINMENT.
2. FOR PLANNING PURPOSES, THE SECONDARY CONTAINMENT AREA SIZE SHOWN HERE IS BASED UPON A 6'-0" (MAXIMUM ALLOWABLE) HEIGHT VERTICAL DIKE WALL INCLUDING 1'-0" OF FREEBOARD WITH A WALL THICKNESS OF 1'-0".
3. GROUPS OF TANKS, WITH NO TANK LARGER THAN 10K BBLs AND NOT EXCEEDING 15K BBLs IN AGGREGATE CAPACITY, MAY BE ENCLOSED IN A SINGLE DIKED CONTAINMENT ENCLOSURE. SUBDIVIDE EACH DIKED CONTAINMENT ENCLOSURE CONTAINING TWO OR MORE TANKS BY INTERMEDIATE WALLS NO LESS THAN 18" IN HEIGHT TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK. SEE SHEET CD-08 FOR INTERMEDIATE WALL DETAIL.
4. THE MAXIMUM ALLOWABLE WALL HEIGHT IS 6'-0". UFC 3-460-01 REQUIRES A MINIMUM OF 12" OF FREEBOARD. VERTICAL CONCRETE DIKE WALLS ARE AN ACCEPTABLE ALTERNATIVE WHEN THERE IS NOT ENOUGH LAND AVAILABLE FOR TRAPEZOIDAL BERMS. SECONDARY CONTAINMENT AREA DESIGN SHALL COMPLY WITH UFC 3-460-01, 29 CFR 1910.106, NFPA 30 AND OTHER FEDERAL, STATE, COUNTY, AND LOCAL REGULATIONS.
5. NO VEHICLE ACCESS IS PERMITTED WHEN VERTICAL DIKE WALLS ARE UTILIZED.
6. SECONDARY CONTAINMENT SHALL BE PROVIDED BY A FUEL IMPERMEABLE LINER. THE LINER SHOULD BE A FLEXIBLE MEMBRANE LINER (FML) PER UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM. A 60 MIL HIGH DENSITY POLYETHYLENE (HDPE) LINER MAY BE USED IF THE LINER IS COMPLETELY COVERED WITH CONCRETE. BALLAST MATERIAL NEEDS TO BE PROVIDED TO PREVENT WIND UPLIFT DAMAGE TO THE LINER. BALLAST MATERIALS INCLUDE CONCRETE SURFACING, SMOOTH RIVER ROCK, SAND TUBES, AND PRECAST CONCRETE BLOCKS. WIND UPLIFT CALCULATIONS ARE REQUIRED IF ANY PORTION OF THE FML IS EXPOSED. SEE UFGS SECTION 33 56 63 FOR FURTHER GUIDANCE.
7. CONCRETE DIKE SURFACING SHALL BE PER UFGS SECTION 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES. THE CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBERS. LOCATE CONTROL JOINTS NO GREATER THAN 10 FEET APART AND SEAL THE JOINTS USING FUEL RESISTANT JOINT SEALANT (NON-SAG ON THE SLOPES). SEE SHEET C-04 FOR A TYPICAL JOINT LAYOUT PLAN. AT A MINIMUM, ALL (NON-ELEVATED) AST CONTAINMENT BASINS SHALL HAVE A CONCRETE WORKING SURFACE AROUND THE PERIMETER OF THE TANK FOUNDATION NOT LESS THAN 10'-0" IN WIDTH.
8. SLOPE DIKE BASIN SURFACES A MINIMUM OF 1% FOR DRAINAGE. DRAINAGE SWALES SHOULD BE SLOPED NO FLATTER THAN 0.5% TO THE DRAINAGE INLET. SEE SHEET CD-09 FOR INLET DETAILS.
9. PROVIDE STEEL STAIRWAYS OVER THE DIKE WALLS. NO LESS THAN TWO DIKE STAIRWAYS SHALL BE PROVIDED OVER DIKE WALLS FOR EMERGENCY EGRESS. SEE DETAILS ON SHEET CD-07.
10. CONSTRUCT A CONTAINMENT DRAIN LINE FROM THE DRAINAGE INLET TO THE CONTAINMENT DRAIN VALVE USING DUCTILE IRON PIPING. A NORMALLY CLOSED, LOCKABLE ECCENTRIC PLUG VALVE SHALL BE PROVIDED TO CONTROL DRAINAGE AND MUST BE ACCESSIBLE DURING A FIRE. SEE DETAILS ON SHEET CD-09.
11. DO NOT USE BURIED CONTAINMENT DRAIN VALVES IN CLIMATES WITH LOWEST ONE-DAY MEAN TEMPERATURE BELOW -10°F PER API STANDARD 650 FIGURE 4.2. PROVIDE MEANS TO CONTROL DRAINAGE THAT WILL NOT NORMALLY REMAIN FROZEN AFTER THAW OF SECONDARY CONTAINMENT CONTENTS. CONTAINMENT DRAIN VALVE OR OTHER CONTROL MEANS, WHEN PROVIDED, SHALL BE LOCKABLE.
12. PROVIDE FIRE HYDRANTS TO PROTECT POL STORAGE FACILITIES IN ACCORDANCE WITH UFC 3-460-01 & 3-600-01, INCLUDING A MINIMUM OF TWO HYDRANTS SPACED A MAXIMUM OF 300 FT APART. LOCATE HYDRANTS SUCH THAT ASTs CAN BE REACHED BY HOSE LAYS NOT EXCEEDING 300 FT IN LENGTH. FIRE HYDRANTS MUST BE ACCESSIBLE TO FIRE DEPARTMENT PUMPER VEHICLES.
13. FOR A TYPICAL PIPING LAYOUT PLAN SEE SHEET C-05.
14. FOR EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS. SEE UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM FOR MATERIALS.

TABLE 1

GENERAL TANK INFORMATION						SECONDARY CONTAINMENT DIMENSIONS (6' HIGH DIKES)	
NOMINAL TANK SIZE (K BBL)*	NOMINAL DIAMETER (FT)	NOMINAL SHELL HEIGHT (FT)*	SHELL VOLUME (K BBL)**	USABLE VOLUME (K BBL)**	LLA VOLUME (BBL)**	VERTICAL CONTAINMENT WALLS	
						"X" (FT)***	"Y" (FT)***
5	39	32	6.8	5.0	625	90	90
10	49	40	13.4	10.0	1175	125	125
20	61	48	25.0	20.0	1825	170	170
30	73	48	35.8	28.9	2675	205	205
40	89	48	53.2	41.1	5300	250	250
50	90	56	63.5	50.6	5425	270	270
60	113	56	100.1	80.1	8825	340	340
100	126	56	124.5	100.1	11150	380	380

- * NOMINAL TANK SIZE = APPROXIMATE USABLE VOLUME = VOLUME FROM LLA TO HLA.
- ** APPROXIMATE VOLUME BETWEEN SUMP AND LLA.
- *** SHELL VOLUME = VOLUME INSIDE ALL OF THE SHELL.
- **** DISTANCE IS MEASURED FROM THE OUTSIDE OF THE VERTICAL WALLS.

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DATE	1/1/2011
BY	CD-08
CHKD	CD-08
APPD	CD-08
REV	



US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

PROJECT	CD-08
DESIGN	CD-08
CONSTRUCTION	CD-08
OPERATION	CD-08
MAINTENANCE	CD-08
REPAIR	CD-08
REPLACEMENT	CD-08
RECONSTRUCTION	CD-08
REDEMPTION	CD-08
REUSE	CD-08
RECYCLING	CD-08
REPAIR	CD-08
REPLACEMENT	CD-08
RECONSTRUCTION	CD-08
REDEMPTION	CD-08
REUSE	CD-08

DATE	1/1/2011
BY	CD-08
CHKD	CD-08
APPD	CD-08
REV	

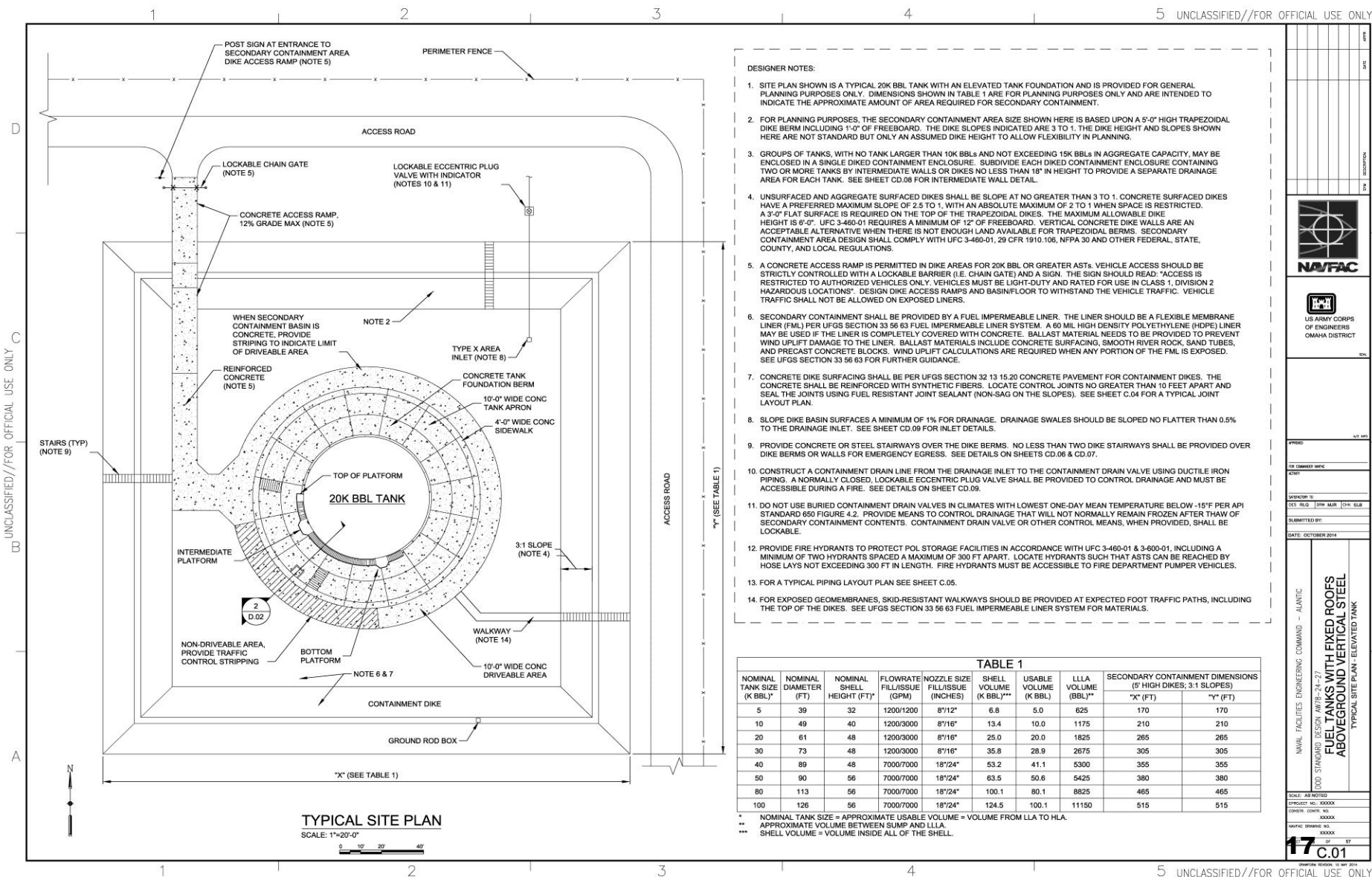
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Non-Mounded Tank

Add photo of non-mounded tank

Typical Site Plan – Mounded Tank



Mounded Tank



TABLE 1

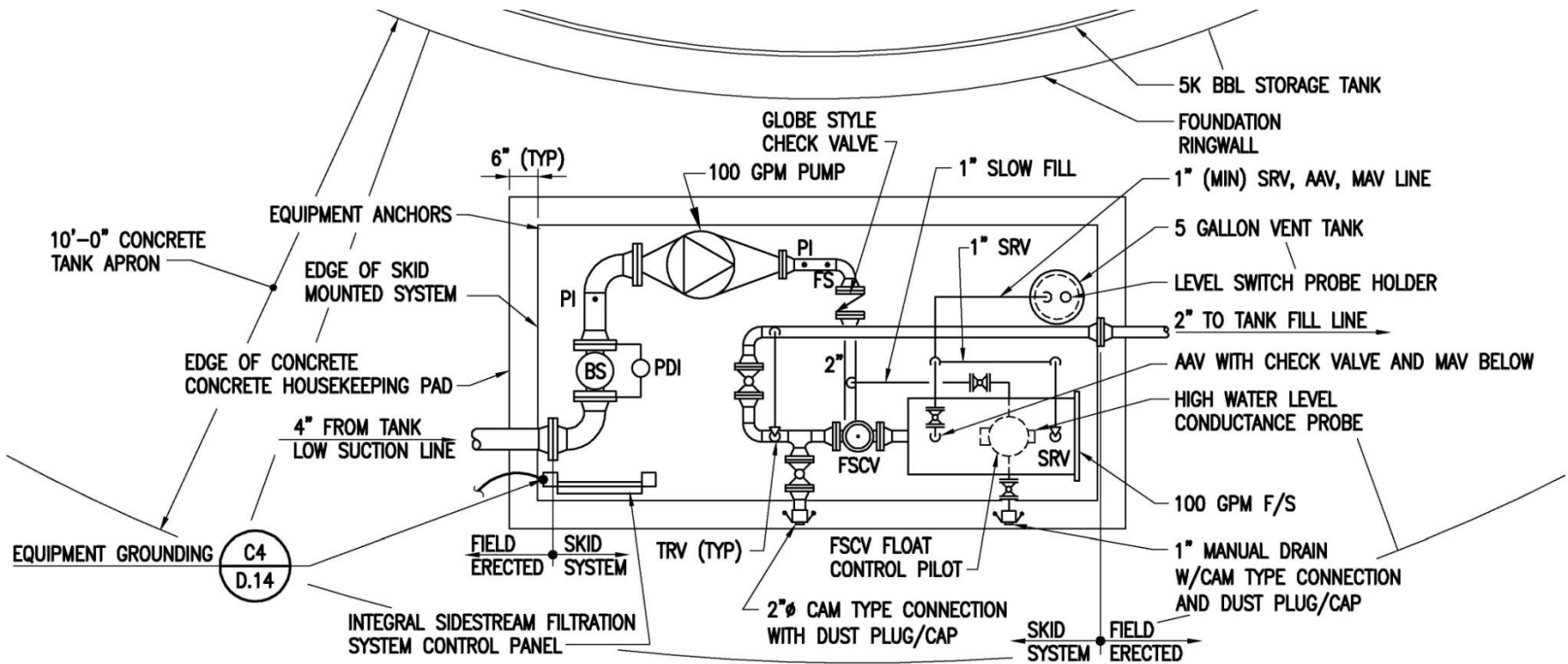
NOMINAL TANK SIZE (KBBL)*	NOMINAL DIAMETER (FT)	NOMINAL SHELL HEIGHT (FT)*	FLOWRATE FILL/ISSUE (GPM)	NOZZLE SIZE FILL/ISSUE (INCHES)	SHELL VOLUME (KBBL)***	USABLE VOLUME (KBBL)	LLA VOLUME (BBL)**	SECONDARY CONTAINMENT DIMENSIONS	
								"X" (FT)	"Y" (FT)
5	39	32	1200/1200	8"/12"	6.8	5.0	625	130	130
10	49	40	1200/3000	8"/16"	13.4	10.0	1175	170	170
20	61	48	1200/3000	8"/16"	25.0	20.0	1825	220	220
30	73	48	1200/3000	8"/16"	35.8	28.9	2675	255	255
40	89	48	7000/7000	18"/24"	53.2	41.1	5300	305	305
50	90	56	7000/7000	18"/24"	63.5	50.6	5425	330	330
80	113	56	7000/7000	18"/24"	100.1	80.1	8825	405	405
100	126	56	7000/7000	18"/24"	124.5	100.1	11150	450	450

* NOMINAL TANK SIZE = APPROXIMATE USABLE VOLUME = VOLUME FROM LLA TO HLA.

** APPROXIMATE VOLUME BETWEEN SUMP AND LLA.

*** SHELL VOLUME = VOLUME INSIDE ALL OF THE SHELL

GRAPHIC SCALE



NOTES:

1. SYSTEM SHALL BE FACTORY ASSEMBLED, SKID MOUNTED, FACTORY RUN.
2. PROVIDE ONLY CLASS 1, DIVISION 1, RATED ELECTRICAL COMPONENTS.
3. HEAT TRACE DRAIN PIPING (AND SLOW FILL PIPING TO FIRST VALVE) IN COLD CLIMATES.
4. PIPING ARRANGEMENT SHOWN IS CONCEPTUAL ONLY.
5. COORDINATE LOCATION OF CONCRETE HOUSEKEEPING PAD WITH PAVING JOINTS TO PREVENT CRACKING.

OPTIONAL SIDESTREAM FILTRATION SYSTEM

SCALE: 1/2"=1'-0"

(C1 D.13)

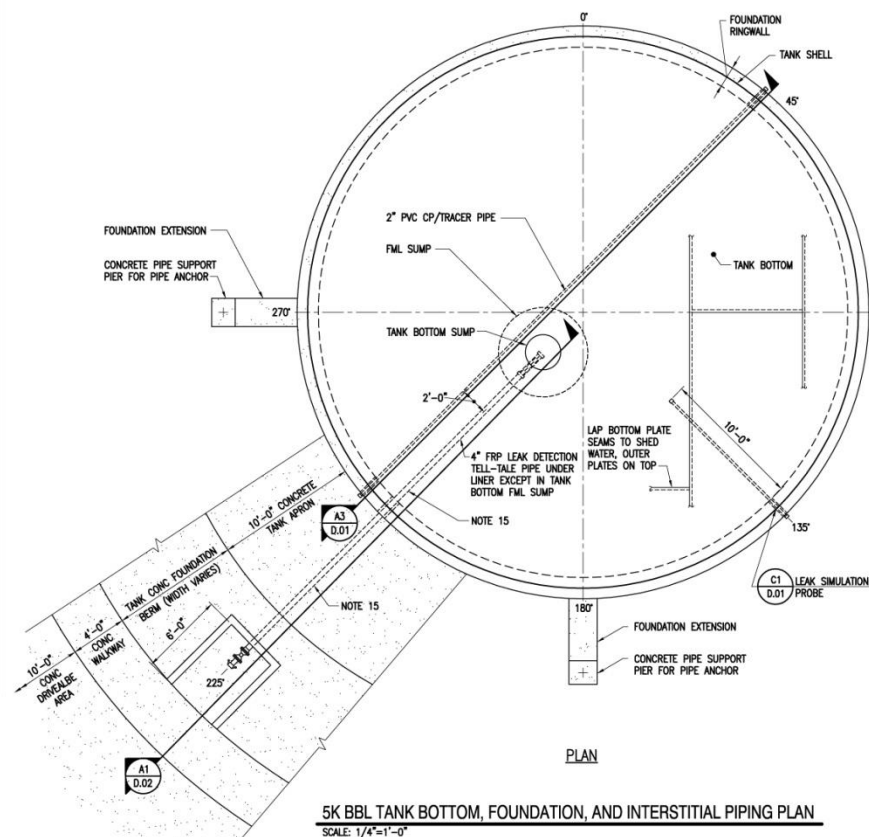
* G.05, D.12



ITEM	DESCRIPTION	SIZE (INCHES)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL (DETAIL/SHEET SHOWN)	NOTES
A	ISSUE	12	270	1'-1 1/2"	A1/D.08	NOTES 4, 5, 10
B	FILL	8	180	1'-1 3/4"	C1/D.08	NOTES 4, 5, 10
C	LOW SUCTION	4	-	1'-1 1/2"	A3/D.07, C1/D.10	NOTES 5, 13
D	WATER DRAW-OFF	2	-	11 7/8"	A3/D.07, C1/D.10, A1/D.13	NOTES 9, 13
E	PRODUCT RETURN	2	246	7"	A1/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	C4/D.10, A4/D.10	NOTES 2, 17
G	SHELL MANHOLE (UPPER)	36	162	9'-9"	C4/D.10, A4/D.10	NOTES 8, 17
H	ATG GAUGE WELL	10	259	16'-6"	A1/D.07	NOTE 16
I	ATG WATER PROBE WELL	8	235	4'-0 1/2"	C4/D.07	NOTE 8
J	MECHANICAL TAPE LEVEL GAUGE	1 1/2	90	-	C1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	230	3'-9" 2'-1"	C1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	230	28'-1" 26'-3"	C3/D.12	NOTE 7
M	SAMPLE GAUGE WELL	10	280	16'-6"	C3/D.07	NOTE 16
N	ROOF MANHOLE/LADDER HATCH	36 x 48	295	13'-6"	A1/D.09	
O	CENTER ROOF VENT	24	-	-	C4/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 x 24	45 135 225 315	-	C1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 x 36	45	28'-1"	A4/D.07	NOTE 12
R	PAN INSTALLATION HATCH	-	45	-	-	NOTE 3
S	SUMP	30	225	4'-0"	A3/D.07	
T	GROUNDING LUGS	3 x 3 x 3/8	20 110 200 290	1'-0"	A1/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	2'-5"	-	NOTE 11
V	SCAFFOLD CABLE SUPPORTS	-	135 315	6'-0"	-	

NOTES

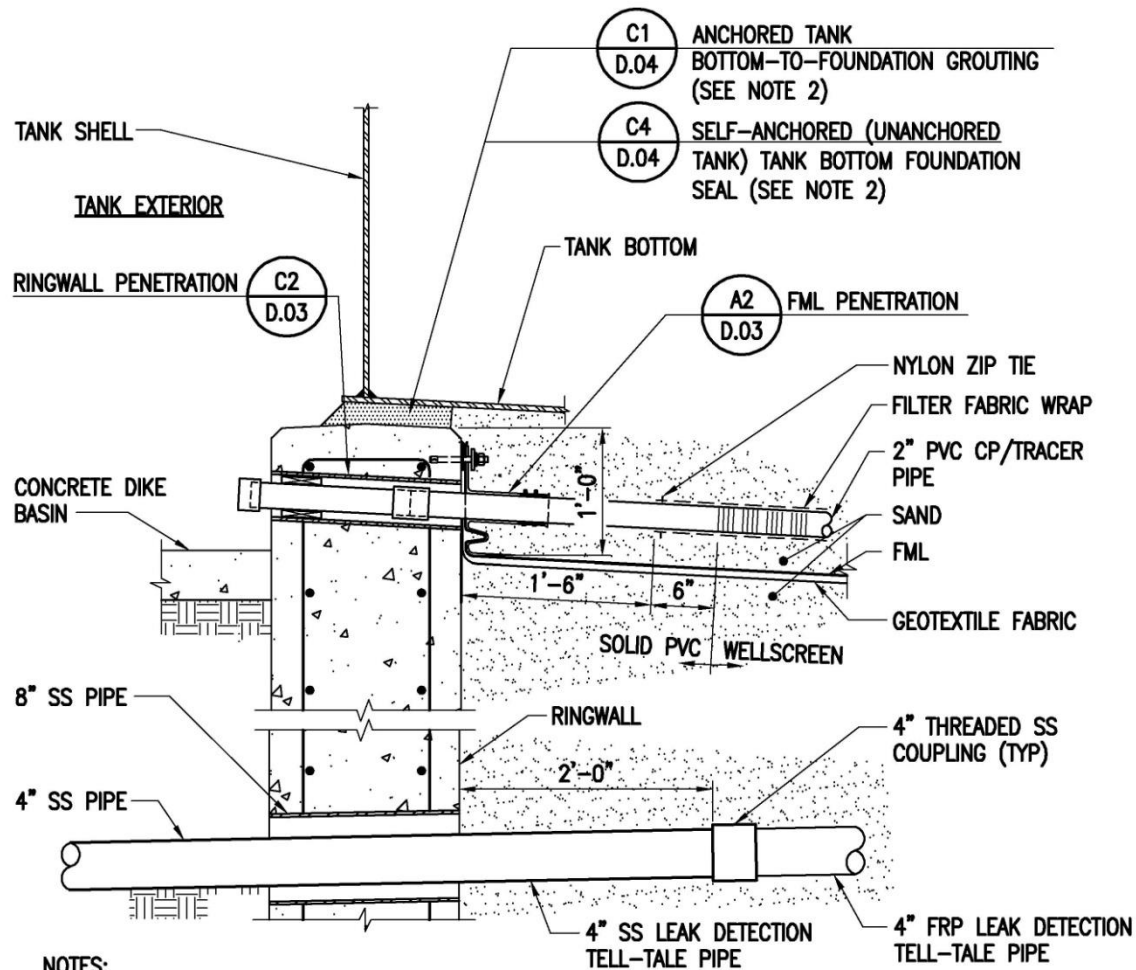
1. DISTANCE VALUES SHOWN ON TABLE FOR SHELL NOZZLES ARE AS MEASURED FROM THE BOTTOM OF THE SHELL TO THE CENTERLINE OF SHELL NOZZLES. DISTANCE VALUES SHOWN ON TABLE FOR ROOF NOZZLES ARE AS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF ROOF NOZZLES. DISTANCE VALUE SHOWN ON TABLE FOR TANK BOTTOM SUMP IS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF THE SUMP.
2. ALIGN LOWER SHELL MANHOLES 180° APART AND PARALLEL WITH PREVAILING WINDS.
3. PROVIDE A PAN INSTALLATION HATCH ON THE FIXED ROOF IN ACCORDANCE WITH THE PAN MANUFACTURER'S REQUIREMENTS.
4. SIZE OF FILL AND ISSUE NOZZLES AND PIPING MUST BE DETERMINED BY THE DESIGNER. REFER TO UFC 3-480-01 FOR DESIGN FLOWRATES WHEN SIZING TANK PIPING.
5. ADJUST SIZE OF FILL, ISSUE AND LOW SUCTION NOZZLES TO SUIT SITE CONDITIONS SUCH AS DISTANCE TO PUMPS AND OPERATIONAL REQUIREMENTS.
6. LOCATE UPPER SHELL MANHOLE 3'-6" ABOVE UPPER SURFACE OF FLOATING PAN AT HIGH LEG POSITION.
7. HIGH LEVEL SHUT-OFF VALVE FLOAT PILOT ASSEMBLY, AS WELL AS HIGH AND HIGH-HIGH LEVEL ALARM SENSORS, SHALL BE ACCESSIBLE FROM SPIRAL STAIRWAY INTERMEDIATE PLATFORM.
8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.
9. THE 2" WATER DRAIN-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MINOR INDENTATIONS, PROVIDE INTERMEDIATE WATER DRAIN-OFF PIPING REDUCED TO 1" SIZE NEAR THE INTERNAL NOZZLE FLANGE TO LIMIT THE AMOUNT OF WATER THAT IS RETAINED IN THE INTERNAL PIPING.
10. THE ELEVATION OF FILL AND ISSUE NOZZLE SIZES 12" AND LARGER SHALL BE AS LOW AS ALLOWED BY API STD 650 USING LOW LINE REINFORCING PLATES. NOZZLE SIZES SMALLER THAN 12" SHALL BE AS LOW AS ALLOWED BY API STD 650 USING REGULAR TYPE REINFORCING



11. FLOATING PAN LOW-LEVEL SHALL PROVIDE A MINIMUM OF 6" CLEARANCE FROM THE TOP OF ANY INTERNAL NOZZLE FLANGE TO THE BOTTOM OF THE FLOATING PAN.
12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" HIGHER IN ELEVATION AT THAT LOCATION AND ENSURE THE REMAINING OVERFLOWS ARE ADEQUATE.
13. INSTALL LOW SUCTION AND WATER DRAW-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
14. ALL SHELL AND ROOF NOZZLES SHALL BE FLANGED UNLESS OTHERWISE INDICATED.
15. INTERSTITIAL PIPING FOR EVAPORATED TANK FOUNDATION IS SHOWN, FOR NON-ELEVATED TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN, SEE B3/D.01.
16. MOUNT THE 8" ATG AND SAMPLE GAUGE WELLS THROUGH 10" FLANGED ROOF NOZZLES PER THE INDICATED DETAILS.
17. THE MAXIMUM DISTANCE FROM THE SHELL MANHOLE REINFORCING PLATE TO THE BACKSIDE OF THE MANHOLE FLANGE, AS MEASURED HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

GRAPHIC SCALE(S)

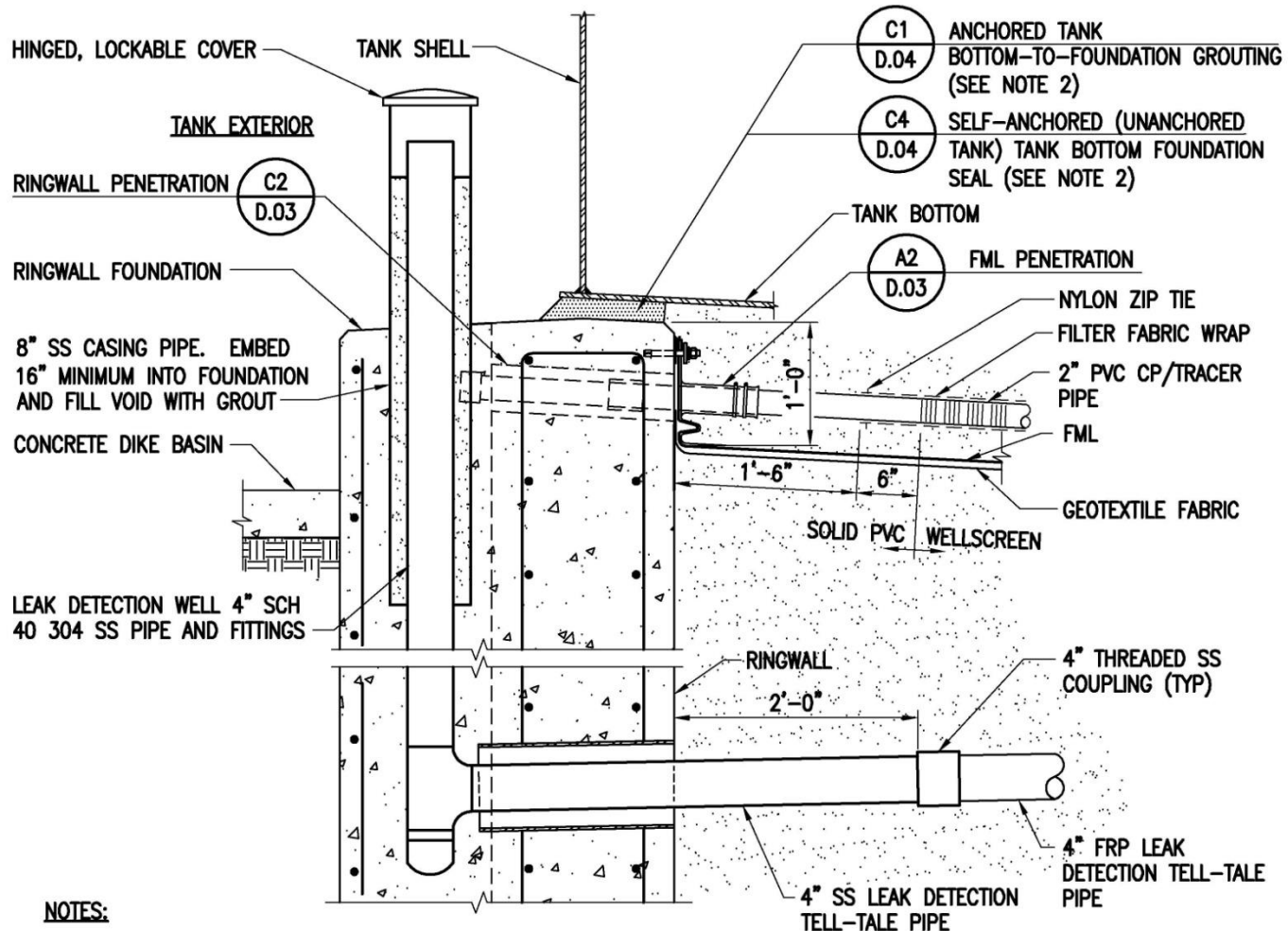




ELEVATED RINGWALL

SCALE: 1"=1'-0"

C4
D.02 D.03



NOTES:

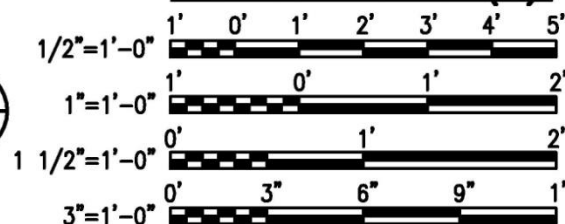
1. 10 KBBL TANK IS SHOWN. OTHER TANK SIZES ARE SIMILAR.
2. TANK BOTTOM FOUNDATION SEAL FOR ANCHORED TANK SHOWN.

NON-ELEVATED RINGWALL

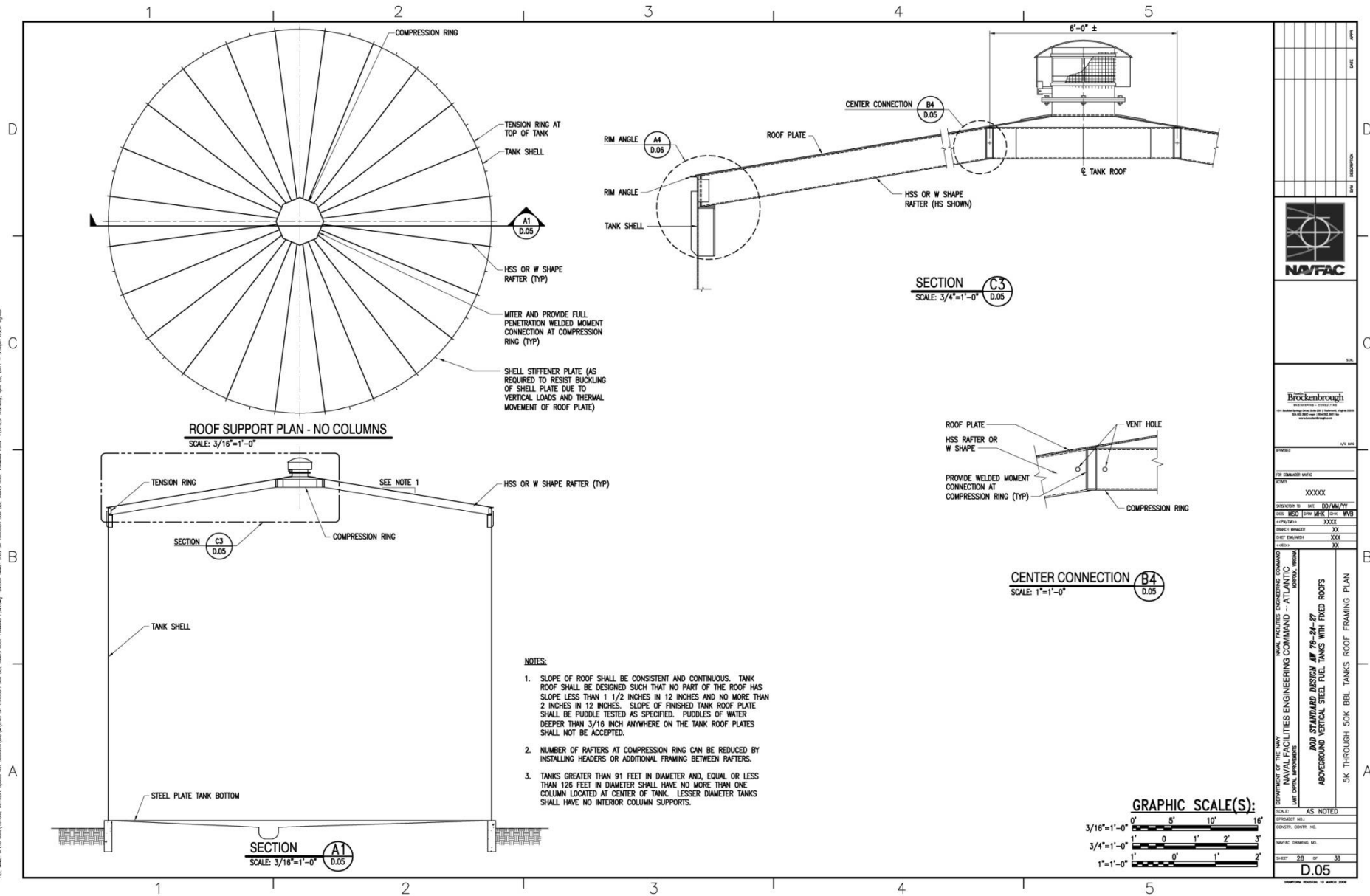
SCALE: 1"=1'-0"

(A4 D.02 D.03)

GRAPHIC SCALE(S):



FILE NAME: C:\110-July10-2016-Rev-001-Update-001-Standard\DWG\50K BBL TANKS ROOF FRAMING PLAN.dwg PLOTTED NAME: 50K BBL TANKS ROOF FRAMING PLAN PLOTTED DATE: 11/20/2016 11:53am USER: jaym



7/12/2017

28

UFGS 33 56 63 Fuel Impermeable Liner System

- Flexible Membrane Liner (FML) **or**
- 60 Mil HDPE Liner
 - NOT Concrete Surface
 - NOT Clay / Bentonite
- Non-Woven Geotextile (Protective Layer)
- Walkway Materials (Slip-Resistant)
- Ballast Materials
 - Concrete
 - Gravel (River Rock)
 - Sand Tubes
 - Precast Concrete Block

Flexible Membrane Liner

- 30 mil Reinforced Liner with a 7.5 oz/sy Base Fabric Material
- Can be Exposed (with Ballast Material)
 - Wind Uplift Calculations are Required
 - Walkways are Required



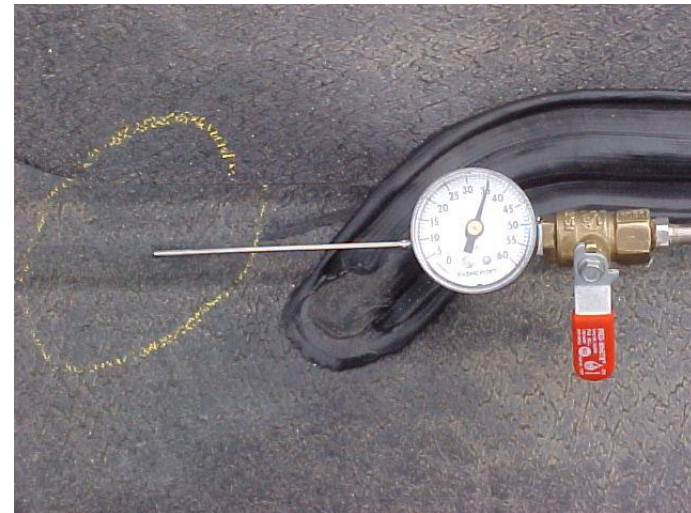
HDPE Liner

- Non-Reinforced 60 mil High Density Polyethylene
- Susceptible to Thermal Expansion and Degradation from UV light
- Must be Completely Covered (Concrete or Gravel)
- Biggest Advantage is Economics

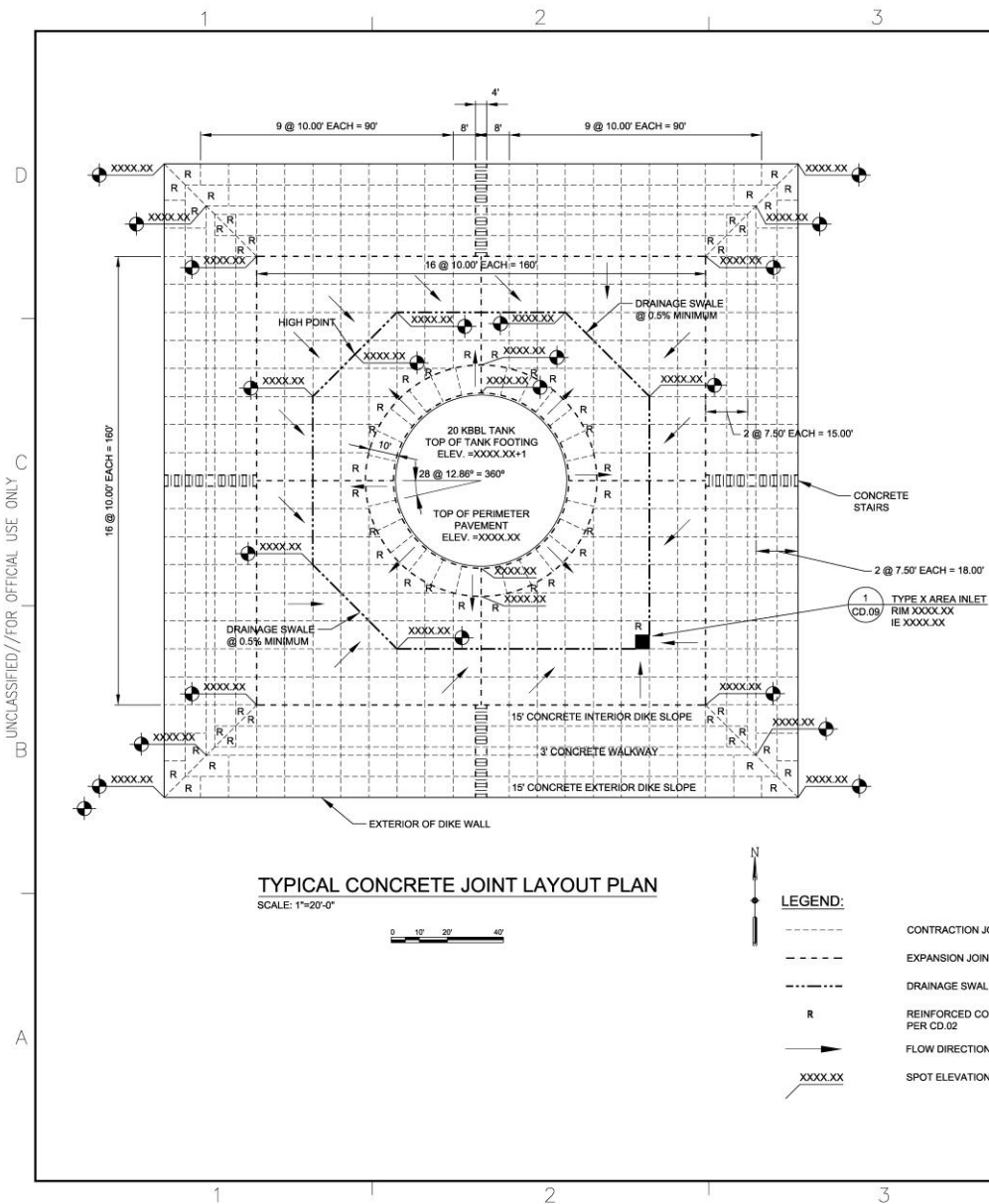
HDPE Liner



Liner Joints and Testing

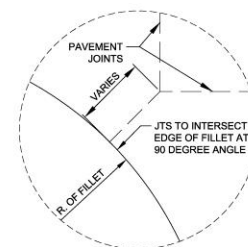


Typical Dike Area Joint Layout Plan

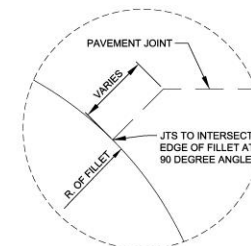


DESIGNER NOTES:

1. JOINT LAYOUT PANELS SHOULD BE AS CLOSE TO SQUARE AS POSSIBLE WITH A MAXIMUM JOINT SPACING OF 10 FEET.
2. EXPANSION JOINTS SHALL BE PLACED AROUND THE TANK FOUNDATION; AT THE DIKE FOOTERS; ON EACH SIDE OF THE CONCRETE STAIRWAYS; AT THE AREA INLET; AND AT THE QUARTER SECTIONS OF THE BASIN, AS INDICATED.
3. ODD SHAPED PANELS SHALL BE REINFORCED WITH WWF.
4. SPOT ELEVATIONS SHALL BE PROVIDED AT THE LOCATIONS INDICATED AND AT OTHER APPLICABLE CHANGE OF GRADE POINTS.
5. THE TOP OF THE TANK FOUNDATION SHALL BE ONE FOOT ABOVE THE CONTAINMENT BASIN, AS INDICATED.
6. PROVIDE POSITIVE DRAINAGE AWAY FROM THE TANK FOUNDATION PERIMETER.
7. PROJECT SPECIFICATIONS SHALL USE UFGS 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES.



JOINT DETAIL A
SCALE: NONE



JOINT DETAIL B
SCALE: NONE

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NAVAC

US ARMY CORPS OF ENGINEERS
CMANNA DISTRICT

DATE: OCTOBER 2014

NAVAL FACILITIES ENGINEERING COMMAND - ATLANTIC

DD FORM 1390-1 (10-13-2013)

PROJECT NO. XXXXXX

CONTRACT NO. XXXXXX

NAVAL DRAWING NO. XXXXXX

34C.04

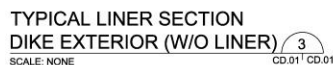
Concrete Surfacing

- UFGS 32 13 15.20 Concrete Pavement for Containment Dikes
- 10' Maximum Joint Spacing
- Synthetic Fiber Reinforcement
- Steel Reinforcement Discontinuous at Joints
- NOT Considered a Fuel Impermeable System on it's Own

Concrete Dikes



1 2 3 4 5 UNCLASSIFIED//FOR OFFICIAL USE ONLY



1. ALL CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBER REINFORCEMENT. ADDITIONAL STEEL REINFORCEMENT SHALL BE PROVIDED, WHERE INDICATED ON THE JOINT LAYOUT PLAN. SEE SPECIFICATIONS SECTION 32 13 20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES FOR CONCRETE AND REINFORCEMENT REQUIREMENTS.
2. PROVIDE A GEOMEMBRANE BOOT FOR ALL CIRCULAR GEOMEMBRANE PENETRATIONS. ALL SMALL LINER PENETRATIONS SHALL BE CIRCULAR TO ACCOMMODATE A BOOT SEAL.
3. ALL JOINTS SHALL BE SEALED PER SPECIFICATIONS SECTION 32 01 19 FELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS. SEE SHEET C-04 FOR THE JOINT LAYOUT PLAN.
4. A GEOTEXTILE SHALL BE INSTALLED BELOW AND ABOVE THE GEOMEMBRANE. SEE SPECIFICATION SECTION 33 56 03 FUEL IMPERMEABLE LINER SYSTEM. THE GEOMEMBRANE AND GEOTEXTILE SHALL BE PROTECTED FROM DAMAGE AT ALL TIMES, AS SPECIFIED.
5. THE SURFACE UNDERLYING THE GEOTEXTILE/GEOMEMBRANE SHALL BE SMOOTH AND FREE OF ROCKS LARGER THAN 1/2 INCH IN DIAMETER OR ANY OTHER MATERIAL WHICH COULD DAMAGE THE GEOMEMBRANE LINER.
6. GEOMEMBRANE ANCHORAGE / EMBEDMENT STRIP MATERIALS AND INSTALLATION SHALL BE AS RECOMMENDED BY THE MANUFACTURER OF THE GEMBRANE.



**TYPICAL CONDUIT OR SMALL
PIPE PENETRATION DETAIL**
SCALE: NONE

1. THE GEOTEXTILE LAYERS ARE PROVIDED TO PROTECT THE GEOMEMBRANE DURING AND AFTER CONSTRUCTION. THE BOTTOM GEOTEXTILE LAYER MAY BE OMITTED IF THE SUBGRADE SOIL IS KNOWN TO BE FREE OF ROCKS OR OTHER MATERIALS THAT COULD POTENTIALLY DAMAGE THE GEOMEMBRANE.



1. WELDED WIRE FABRIC SHALL BE OVERLAPPED FOR A DISTANCE EQUAL TO AT LEAST ONE SPACING OF THE WIRE IN THE FABRIC OR 32 WIRE DIAMETERS, WHICHEVER IS GREATER. THE WIRES IN THE LAP, SHALL BE WIRED OR OTHERWISE SECURELY FASTENED TO PREVENT SEPERATION DURING CONCRETE PLACEMENT.



Walkway / Sand Tubes

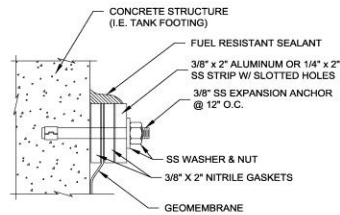


Precast Block Walkways/Ballast



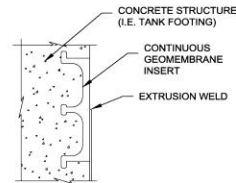
Liner Fastening Details

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NOTE: VARIANCES TO THIS DETAIL MAY BE MADE WHEN RECOMMENDED BY THE GEOMEMBRANE MANUFACTURER.

TYPICAL GEOMEMBRANE TERMINATION DETAIL - EXISTING STRUCTURE
SCALE: NONE

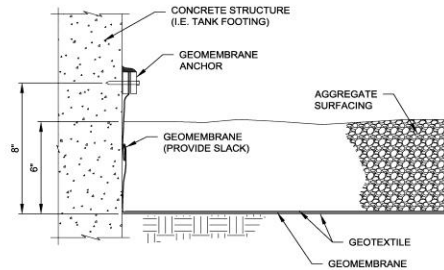


NOTE: GEOMEMBRANE INSERT TO BE MANUFACTURER'S STANDARD

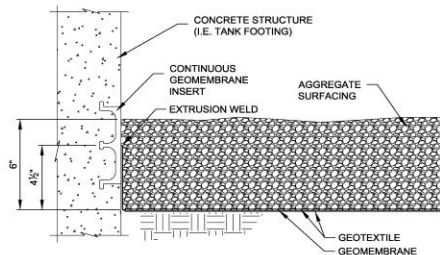
TYPICAL GEOMEMBRANE TERMINATION DETAIL - NEW STRUCTURE
SCALE: NONE

DESIGNER NOTES:

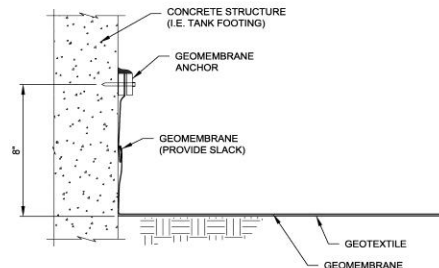
1. THE GEOTEXTILE LAYERS ARE PROVIDED TO PROTECT THE GEOMEMBRANE DURING AND AFTER CONSTRUCTION. THE BOTTOM GEOTEXTILE LAYER MAY BE OMITTED IF THE SUBGRADE SOIL IS KNOWN TO BE FREE OF ROCKS OR OTHER MATERIALS THAT COULD POTENTIALLY DAMAGE THE GEOMEMBRANE.



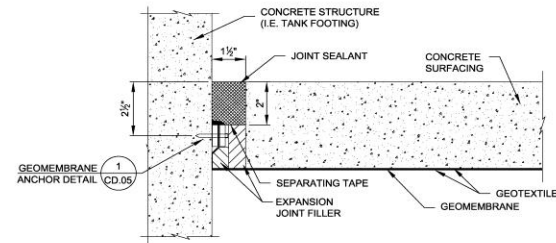
CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE
SCALE: NONE



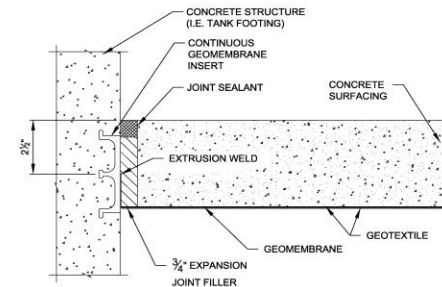
CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE
SCALE: NONE



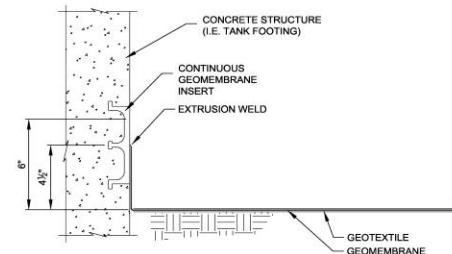
CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE
SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE
SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE
SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE
SCALE: NONE

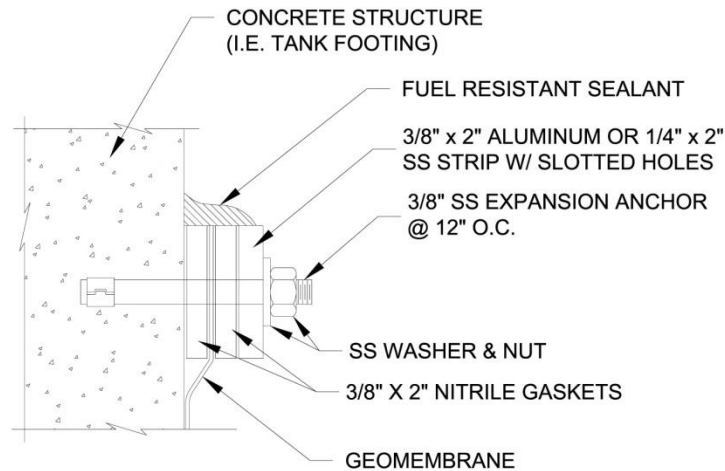


NAVAL FACILITIES ENGINEERING COMMAND - ATLANTIC
3000 STANDARD DESIGN (W/20-24-27)
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL
GEOMEMBRANE FASTENING DETAILS

SCALE: AS NOTED
PROJECT NO: 000000
CONTRACT NO: 000000
NAVFAC DRAWING NO: 000000
43 CD.05

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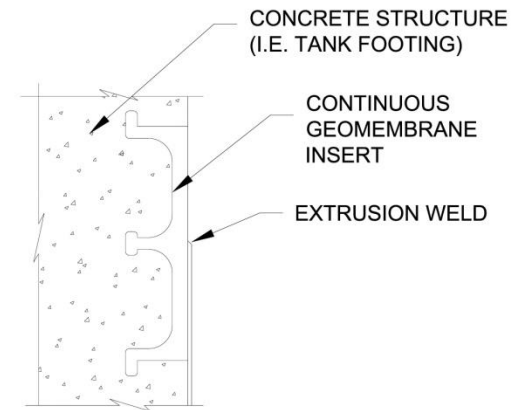
Liner Termination Details



NOTE: VARIANCES TO THIS DETAIL MAY BE MADE WHEN RECOMMENDED BY THE GEOMEMBRANE MANUFACTURER.

TYPICAL GEOMEMBRANE TERMINATION DETAIL - EXISTING STRUCTURE

SCALE: NONE

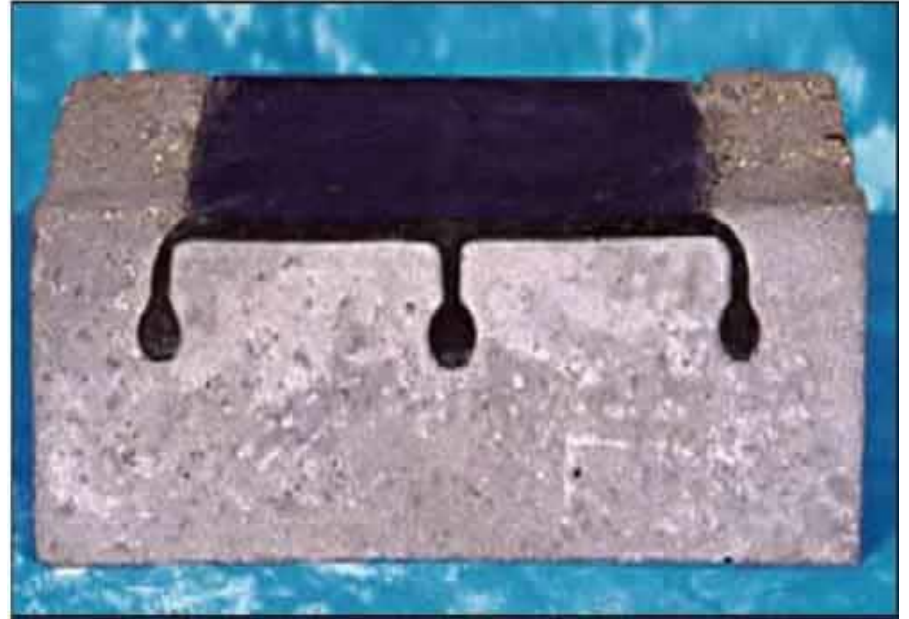


NOTE:
GEOMEMBRANE INSERT TO BE MANUFACTURER'S STANDARD

TYPICAL GEOMEMBRANE TERMINATION DETAIL - NEW STRUCTURE

SCALE: NONE

Embed Strips



Concrete Stairway Details

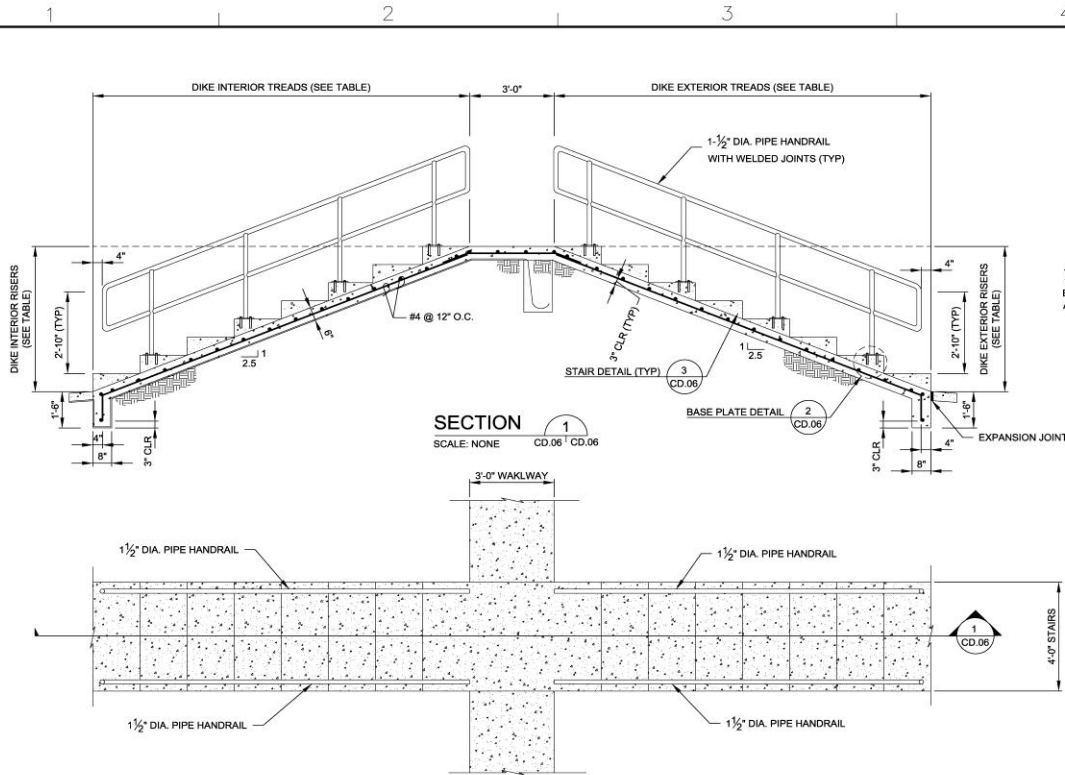
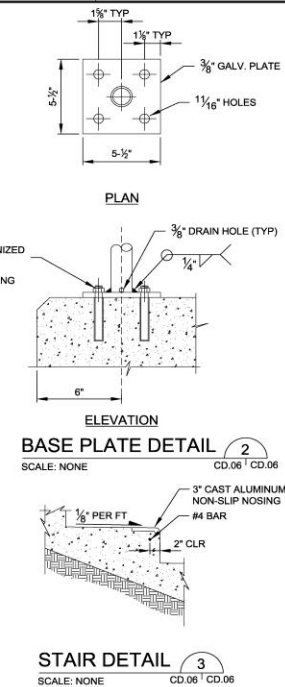


TABLE OF STAIR DIMENSIONS				
STAIR NUMBER	INTERIOR TREADS	INTERIOR RISERS	EXTERIOR TREADS	EXTERIOR RISERS
1	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"
2	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"
3	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"
4	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"
5	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"	#T @ 8" = 8'-8"	#R @ 8" = 8'-8"

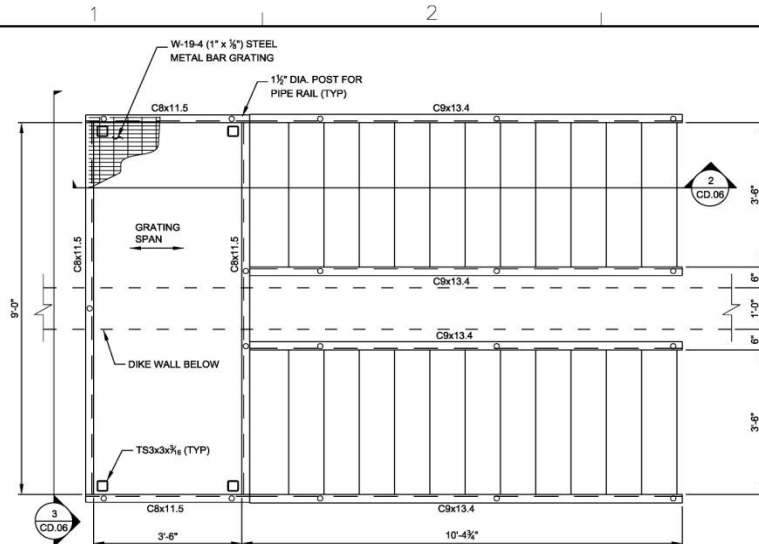
DESIGNER NOTES:

- PER IBC AND ADA GUIDELINES RISERS HAVE A MINIMUM HEIGHT OF 4" AND A MAXIMUM HEIGHT OF 7".
- PER ADA GUIDELINES, TREADS SHALL HAVE A MINIMUM WIDTH OF 11", AS MEASURED FROM RISER TO RISER.
- HANDRAILS SHALL BE EXPOSED GALVANIZED UNLESS PAINTED. RAILS ARE REQUIRED BY THE INSTALLATION. IF PAINTING IS REQUIRED, THE RAILS SHOULD STILL BE GALVANIZED BEFORE PAINTING.

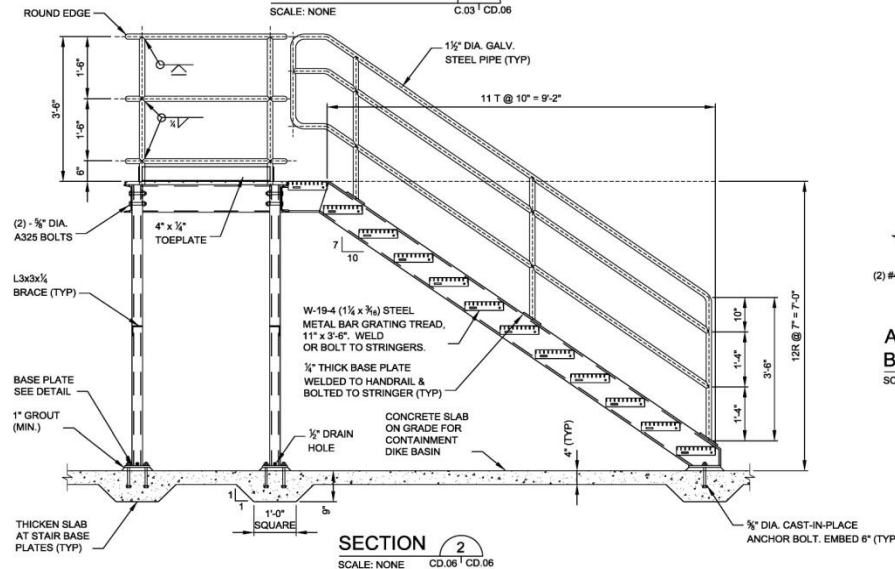


NOTES:
1. PIPE HANDRAIL SHALL HAVE WELDS GROUNDED SMOOTH AND BE HOT DIPPED GALVANIZED AFTER FABRICATION.

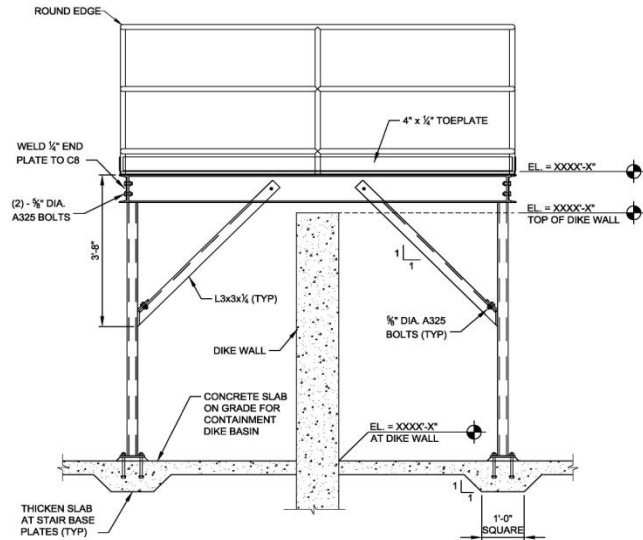
Steel Stairway Details



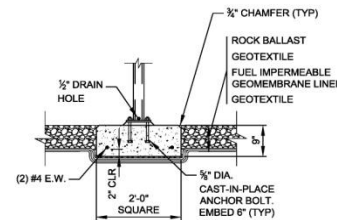
STEEL STAIR PLAN
SCALE: NONE C.03 CD.06



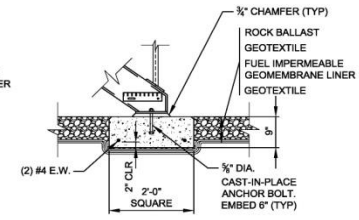
SECTION 2
SCALE: NONE C.06 CD.06



SECTION 3
SCALE: NONE C.06 CD.06



AGGREGATE BASIN TYPICAL BASE PLATE DETAIL
SCALE: NONE



AGGREGATE BASIN TYPICAL STAIR BASE DETAIL
SCALE: NONE

NOTES:

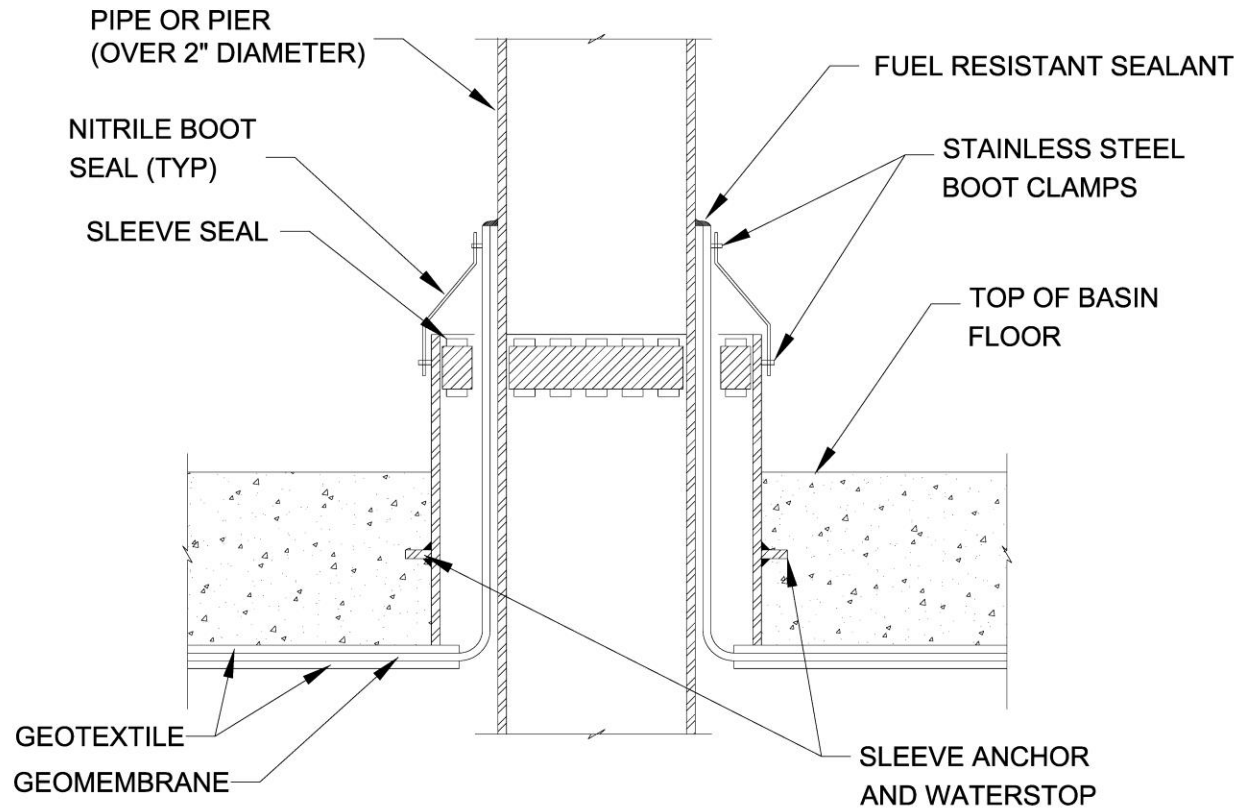
1. METAL GRATING FOR LANDINGS AND STAIR TREADS SHALL BE W-19-4, WITH BEARING BARS AS INDICATED. TREADS AND LANDINGS SHALL HAVE CHECKERED PLATE NOSINGS. GRATING SHALL BE ANCHORED WITH SADDLE CLIPS. MAXIMUM PANEL WIDTH SHALL BE 2'-0". EDGES SHALL BE BANDED. TREADS SHALL BE FABRICATED WITH CARRIER PLATES AT ENDS.
2. ALL GRATINGS, HANDRAILS, STRINGERS, ANGLES, PLATES AND BOLTS FOR STAIRS SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A123.

UNCLASSIFIED//FOR OFFICIAL USE ONLY	
DATE: OCTOBER 2014	CD.07
SUBMITTED BY: DATE: OCTOBER 2014 CD.07	
NAVFAC ENGINEERING COMMAND - ALANTIC STANDARD DESIGN WTR-24-27 CONSTRUCTION NO. 100000 CONTRACT NO. 100000 NAVFAC DRAWING NO. 100000 47 CD.07	
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL STEEL STAIRWAY DETAILS	
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[illegible]

48 CD.08

Basin Floor Penetration Detail

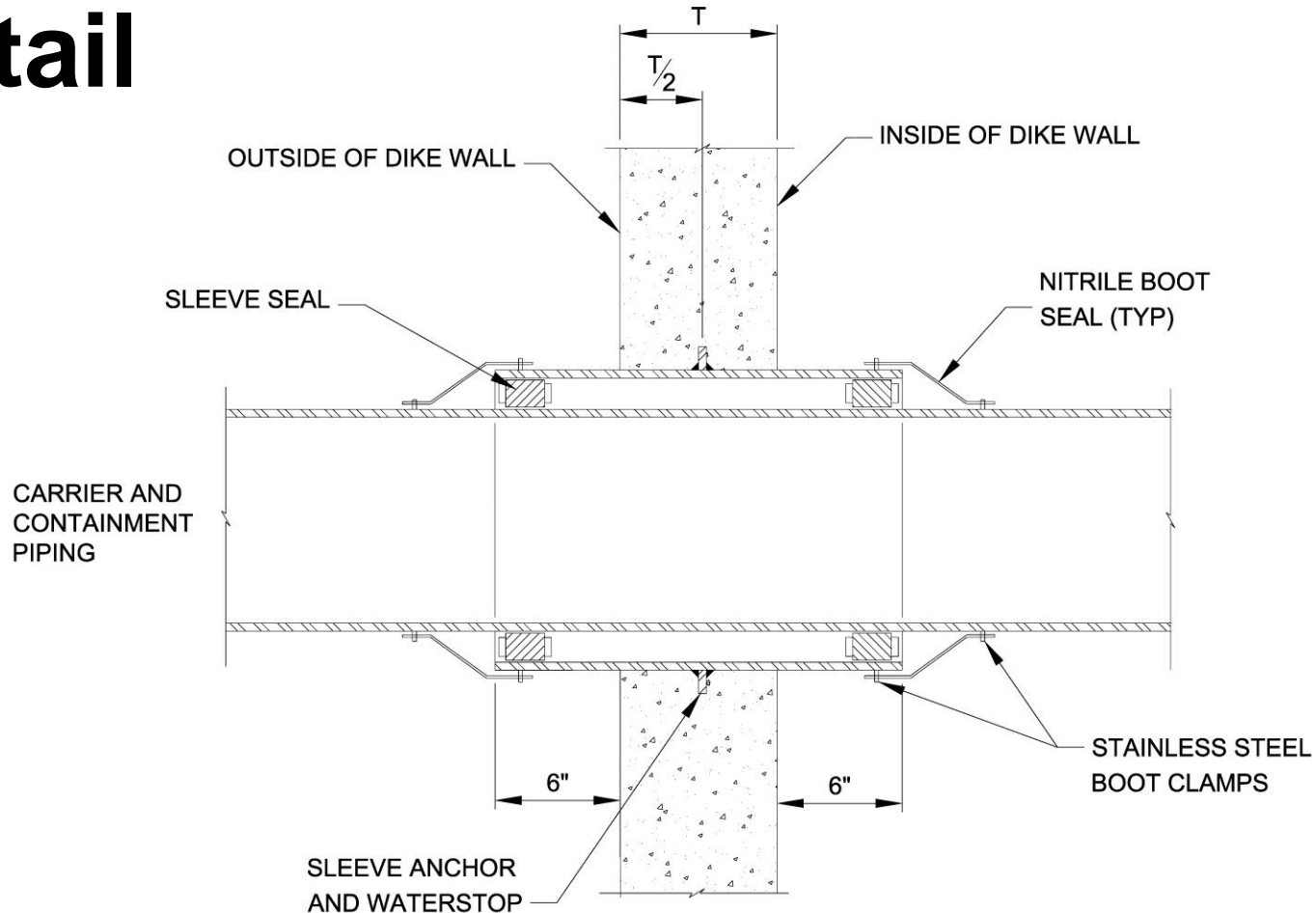


NOTE: FOR PIPES 2" IN DIAMETER OR LESS, SEE DETAIL ON SHEET CD.01.

BASIN FLOOR LARGE PIPE PENETRATION DETAIL

SCALE: NONE

Containment Wall Penetration Detail



CONCRETE WALL PENETRATION DETAIL

SCALE: NONE

Containment Wall Penetration



Containment Wall Control Joint

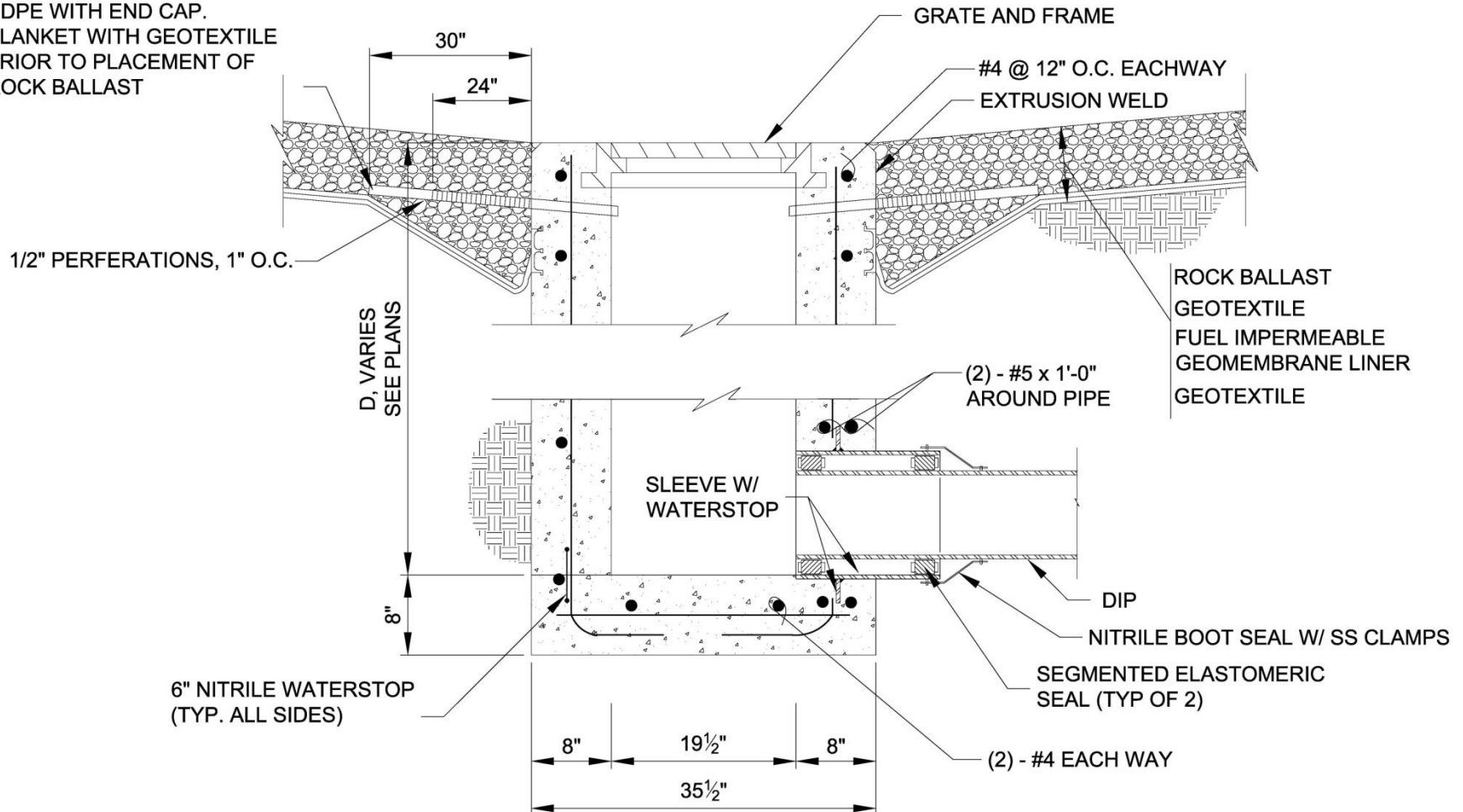


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Inlet Section

WEEP DRAIN (2 EA), 1-1/2" DIA.
HDPE WITH END CAP.
BLANKET WITH GEOTEXTILE
PRIOR TO PLACEMENT OF
ROCK BALLAST



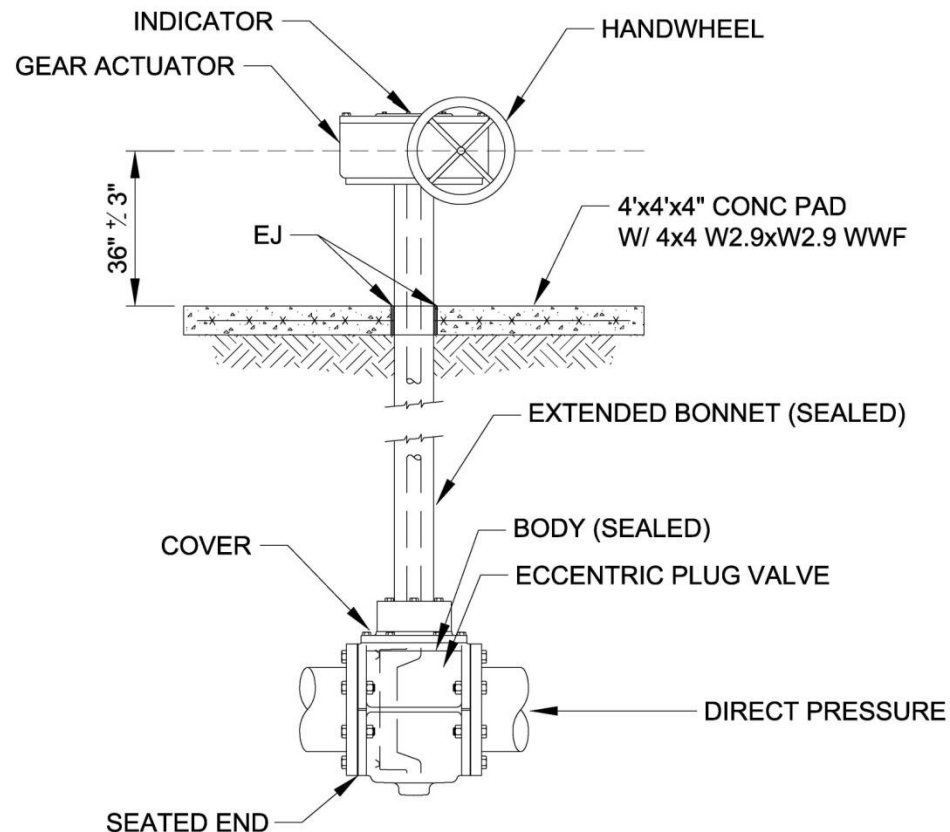
SECTION

3

Precast Inlet

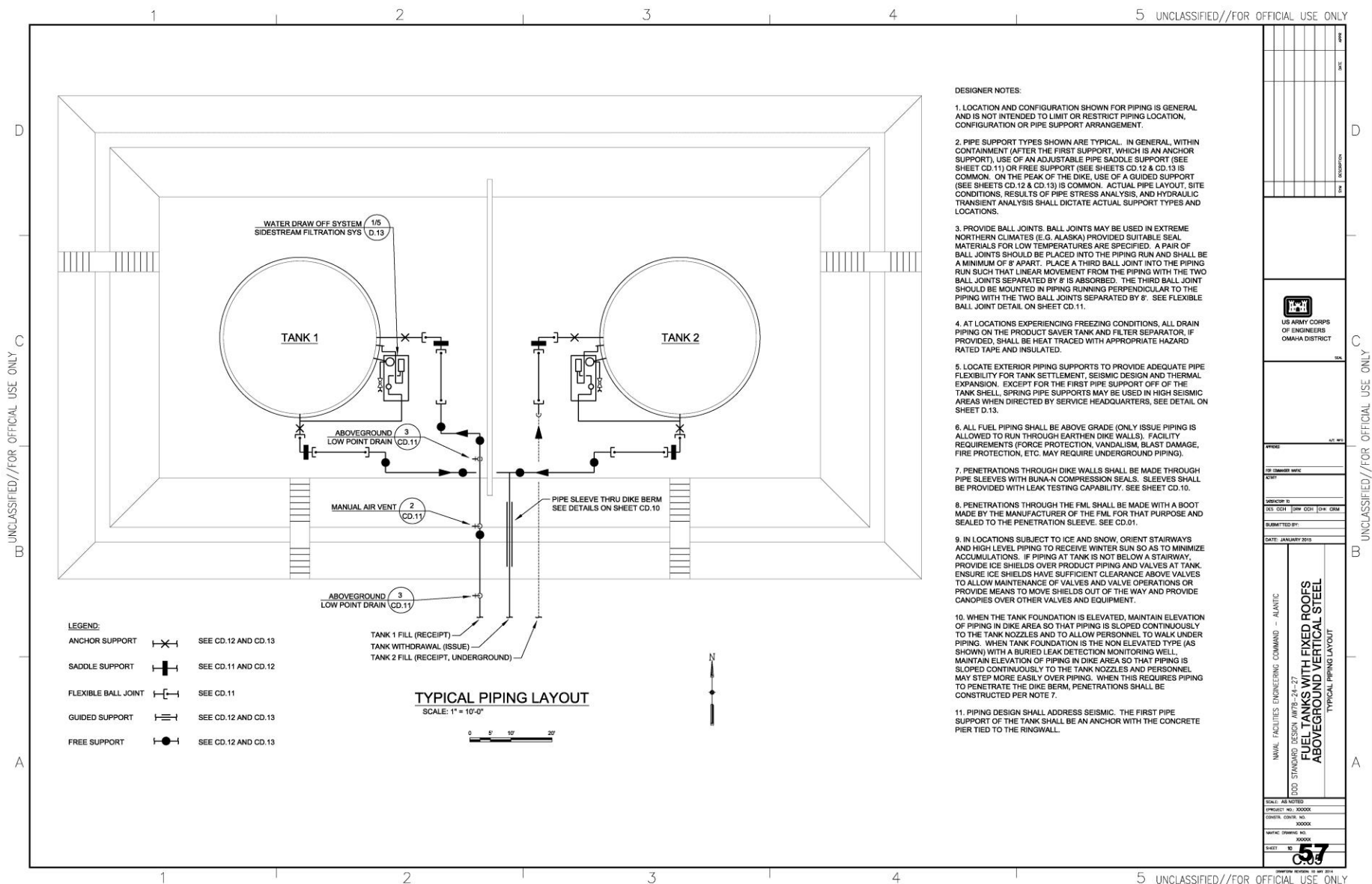


Containment Drain Valve Detail

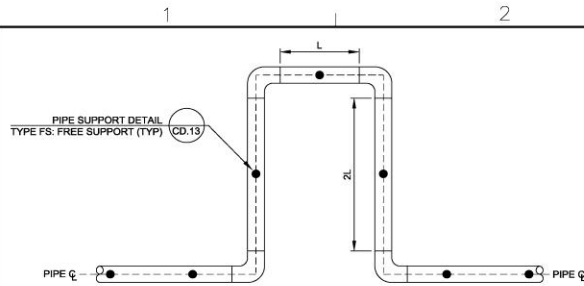


NOTE: 100% PORT ECCENTRIC PLUG VALVE SHALL CONFORM TO AWWA C517 AND BE RESISTANT TO HYDROCARBONS (NITRILE RUBBER SEALS). GEAR ACTUATOR BOX WITH HANDWHEEL SHALL BE LOCKABLE.

Typical Piping Layout



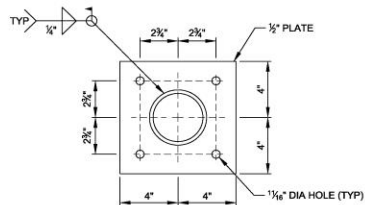
Miscellaneous Details



DESIGNER NOTES:
1. OTHER PIPE SUPPORTS AND SUPPORT LOCATIONS SHALL BE CALCULATED BY A PIPE STRESS ANALYSIS AND HYDRAULIC TRANSIENT COMPUTATIONS.

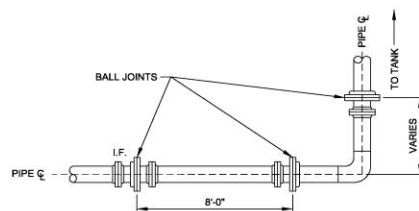
TYPICAL EXPANSION LOOP

SCALE: NONE



BASE PLATE

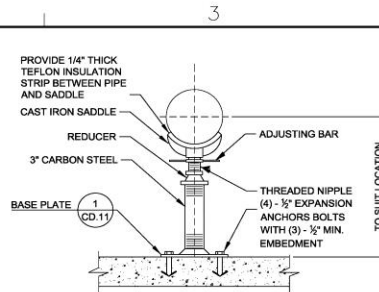
SCALE: NONE CD.11 CD.11



DESIGNER NOTES:
1. DISTANCE TO THIRD BALL JOINT AFTER THE ELBOW SHOULD BE AS LONG AS PIPING LAYOUT ALLOWS WHILE MINIMIZING DROOP, BUT NOT TO EXCEED 8 FEET OR MAXIMUM ALLOWABLE PIPE SUPPORT DISTANCE.

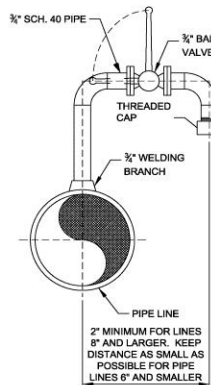
FLEXIBLE BALL JOINTS

SCALE: NONE



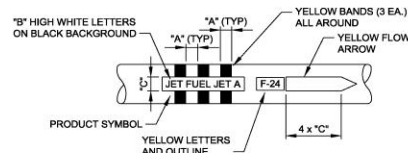
ADJUSTABLE PIPE SADDLE SUPPORT DETAIL (PS-1)

SCALE: NONE



MANUAL AIR VENT

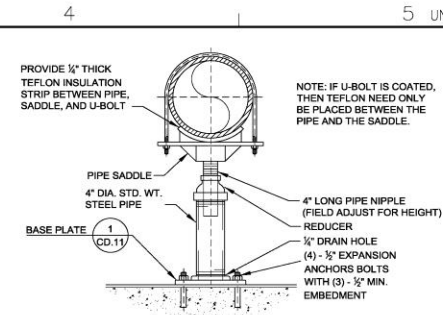
SCALE: NONE C.05 CD.11



DESIGNER NOTES:
THE EXAMPLE MARKINGS SHOWN ARE FOR JET A TURBINE FUEL, FOR OTHER FUEL
TYPES, REFER TO MIL-STD-161G.

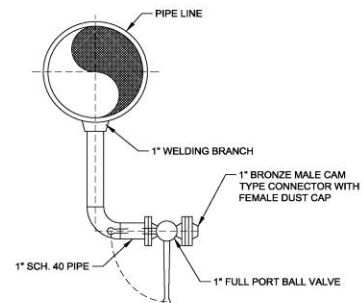
PRODUCT FLOW SYMBOL DETAIL

SCALE: NONE



ADJUSTABLE PIPE SUPPORT DETAIL (PS-2)

SCALE: NONE



DESIGNER NOTES:
1. ENSURE THAT THE ABOVEGROUND LOW POINT DRAIN HAS ADEQUATE CLEARANCE TO ALLOW FOR FULL ROTATION OF THE BALL VALVE HANDLE.

ABOVEGROUND LOW POINT DRAIN

SCALE: NONE

SIZES OF LETTERS AND BANDS			
PIPE DIAMETER (IN)	A BAND WIDTH AND SPACING (IN)	B TITLE LETTER SIZE (IN)	C BACKGROUND AND ARROWS (IN)
UNDER 3	3	0.5	1
3 TO 6	3	1	2
6 TO 9	3	2	3
OVER 9	4	3	4.5

[illegible]

OF ENGINEERS
OMAHA DISTRICT

SYSTEM

FOR COMMANDER: NATHAN

SUFFICIENT TO

SUBMITTED BY:

DATE: JANUARY 2015

NAVAL FACILITIES ENGINEERING COMMAND - ATLANTIC

**FUEL TANKS WITH FIXED ROOFS
ABOVEGROUND VERTICAL STEEL**

SCALE: AS NOTED

PROJECT NO.: 000000

CONSTR. CONTR. NO. **XXXXX**

FOI

58 CD.11

CHANGING VERSION: 10 MAY 2014

OFFICIAL USE ONLY

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B. CARBON STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL CONFORM TO LATEST EDITION OF "THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION "STEEL CONSTRUCTION MANUAL".
 2. WIDE FLANGE SHAPES: SHALL CONFORM TO ASTM A992, Fy = 50 KSI.
 3. ROLLED PLATES AND SHAPES: SHALL CONFORM TO ASTM A36, Fy = 36 KSI.
 4. STRUCTURAL TUBING: SHALL CONFORM TO ASTM A500, Grade B, Fy = 46 KSI.
 5. ANCHOR BOLTS: SHALL CONFORM TO ASTM F1554, Fy = 36 KSI.
 6. WELDING SHALL CONFORM WITH SPECIFICATION 33 52 43.13.
 7. DO NOT WELD CARBON STEEL PLATES OR TEES TO STAINLESS STEEL PIPE.
 8. DO NOT WELD GALVANIZED CARBON STEEL PLATES OR TEES TO STAINLESS STEEL OR CARBON STEEL PIPE.
- C. SOILS & FOUNDATION NOTES:
1. MAX ALLOWABLE NET SOIL BEARING PRESSURE: XXXX PSF
A. ONE-THIRD OVERSTRESS MAY BE ALLOWED FOR TEMPORARY WIND/SEISMIC LOADING.
 2. LATERAL BEARING PRESSURE: XXX PSF/FT BELOW FINISHED GRADE
 3. FRICTION ANGLE: $\phi = XX^\circ$
 4. LATERAL EARTH PRESSURE COEFFICIENTS:
A. ACTIVE: $K_a = X.XX$
B. AT REST: $K = X.XX$
C. PASSIVE: $K_p = X.XX$
 5. COEFFICIENT OF FRICTION: $\mu = X.XX$
 6. FROST PENETRATION: XX°

C. SOILS & FOUNDATION NOTES:

1. MAX ALLOWABLE NET SOIL BEARING PRESSURE: X,XXX PSF
A. ONE-THIRD OVERSTRESS MAY BE ALLOWED FOR TEMPORARY WIND/SEISMIC LOADING.
2. LATERAL BEARING PRESSURE: XXX PSF/FT BELOW FINISHED GRADE
3. FRICTION ANGLE: $\phi = XXX^\circ$
4. LATERAL EARTH PRESSURE COEFFICIENTS:
A. ACTIVE: $K_a = XXX$
B. AT-REST: $K = XXX$
C. PASSIVE: $K_p = XXX$
5. COEFFICIENT OF FRICTION: $\mu = X,XX$
6. FROST PENETRATION: XX'



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1. PROVIDE CARBON STEEL PIPE SUPPORTS, INCLUDING: STRAPS, PLATES, GUIDES AND TEES WHERE CARBON STEEL PIPE IS USED. ALL CARBON STEEL ELEMENTS SHALL HAVE THE SAME MECHANICAL PROPERTIES. PROVIDE STAINLESS STEEL PIPE SUPPORTS, INCLUDING: STRAPS, PLATES, GUIDES AND TEES WHERE STAINLESS STEEL PIPE IS USED. ALL STAINLESS STEEL ELEMENTS SHALL HAVE THE SAME MECHANICAL PROPERTIES. DO NOT WELD CARBON STEEL PLATES OR TEES TO STAINLESS STEEL PIPE.

2. THE 15 1/4" x 3/8" HORIZONTAL PLATE BETWEEN SADDLES SHALL HAVE 1" X 1" TRIANGLES CUT OFF OF ALL 4 CORNERS. THE PLATE SHALL NOT BE SQUARE IN SHAPE SO AS TO AVOID 3 WELDS INTERSECTING IN THE CORNERS, WHICH CAUSES AREAS OF HIGH RESTRAINT AND INCREASED POTENTIAL FOR CRACKING.

[illegible]

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- [illegible]

Criteria Libraries

- **UFCs and Specifications (UFGSs) available at:
The Whole Building Design Guide**

<http://www.wbdg.org>

- **Standard Designs available at:
<http://www.hnd.usace.army.mil/std dgn/>**



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